# Hot Runner User Manual

Mold Masters®
performance delivered

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# Section 1 - Introduction

We would like to take this opportunity to thank you for purchasing a *Mold-Masters* hot runner.
The purpose of this manual is to assist users in the integration, operation and maintenance of *Mold-Masters* systems.

## Intended Use

Mold-Masters Hot Runners and Systems have been built to process thermoplastic material at the required temperature for injection molding and must not be used for any other purpose.

This manual is designed to cover most system configurations. If you need additional information specific to your system, or information in another language, please contact your representative or a *Mold-Masters* office.

## Operator Training and Safety

It is the obligation of the employer to properly train and instruct its personnel in the safe operation of equipment, including maintenance and the use of all the safety devices. In addition, the employer must provide its personnel with all necessary protective clothing, including such items as a face shield and heat resistant gloves. Any instructional material provided by *Mold-Masters* for the operation and maintenance of equipment, does not in any way absolve the employer from fulfilling these obligations and *Mold-Masters* disclaims liability for injury to personnel using equipment supplied.

## Warranty

Your original system documentation contains warranty details. If for any reason, parts must be returned to *Mold-Masters,* it is essential to obtain prior pre-authorization and a return authorization number.

## Documentation

The documentation package provided with your hot runner / system will include any or all of the following:

- EC declaration of conformity
- Parts list containing all system components. Together with the general assembly drawing, the parts list should be referenced when ordering spare parts.
- General assembly drawing used to integrate your hot runner system into the mold.
- Hot half drawing used to integrate hot half to cavity plate.

**NOTE**
This manual should also be used in conjunction with other relevant manuals, e.g. Temperature Controller, E-Drive, or E-Multi manual.

When ordering this manual, please reference the document number below.

## Release Details

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# Section 3 - Safety

## Introduction

High injection pressures and high temperatures are used in the operation of hot runners. To protect the operator in the work place, ensure that all safety devices are installed on the machine.

- Be aware of all warning labels attached to the mold and machine.
- Refer to the machine user manual for safety procedures and checks not included here in the hot runner specific manual.

## Notices

To make the manual easier to use, we have included notices throughout that highlight important information. See below.

**WARNING**
Safety warning indicates a potentially hazardous situation, which if not avoided, could result in serious injury or death.

**CAUTION**
Caution indicates that damage to equipment is possible if instruction is not followed.

**NOTE**
Note indicates useful additional information or is used as a reminder of important information.

## General Safety Warnings

The equipment supplied is subjected to high injection pressures and high temperatures.
Ensure that extreme caution is observed in the operation and maintenance of the hot runner system and the injection molding machines.

- Do not operate the equipment with unconfined long hair, loose clothing or jewelry, including name badges, neckties, etc. These may get caught by the moving belt mechanism and can cause death or serious injury.
- Never disable or bypass a safety device.
- It is highly recommended that all operators wear face shields and use heat resistant gloves when working around the feed throat, purging the machine or cleaning the gates of the mold.
- Check frequently for possible oil or water leaks. Stop the machine and make repairs.
- Remove purgings from the machine immediately.
- Never touch or inspect the timing belt when power is on and motor and controller are connected. Unplug the controller before any maintenance.
- Always cover belt area with proper protecting sheet before any bench test or in-mold testing.
- High voltage and amperage cables are connected to the controller (220VAC). There is also a high voltage cable connection between the servo motor and controller.

- Unplug the controller before performing any maintenance work.
- Hoses fitted to the mold will contain high or low temperature fluids or air under high pressure. The operator must shut down and lockout these systems as well as relieving any pressure before performing any work with these hoses.
- Never perform any work on the mold unless the hydraulic pump has been stopped.
- High voltage and amperage cables are connected to the mold. Electric power must be shut off prior to installing or removing any cables.
- Water and or hydraulics on the mold may be in close proximity to electrical connections and equipment. Water leakage may cause an electrical short circuit. Hydraulic fluid leakage may cause a fire hazard. Always keep water and/or hydraulic hoses and fittings in good condition to avoid leaks.
- All maintenance on *Mold-Masters* products should be performed by properly trained personnel based on local law or regulation requirements. Electrical products may not be grounded when removed from the assembled or normal operating condition.
- Ensure proper grounding of all electrical products before performing any maintenance to avoid potential risk of electrical shock.
- Check that all coolant, hydraulic and air lines as well as electrical cables will not interfere with the moving parts of the mold, machine or robot. The lines must be of sufficient length so that they will not strain or pinch when the mold halves separate.
- For water-cooled gate inserts, coolant must be maintained with the proper mixture to prevent corrosion and circuit blockage.
- Care must be taken to ensure the nozzle terminal ends do not come in contact with the hydraulic fluid. The nozzles may short out or become damaged.
- Do not mix electrical power cables with thermocouple extension cables. They are not designed to carry the power load or list accurate temperature readings in each other's application.

## CAUTIONS

All *Mold-Masters* heated components are manufactured to standards that ensure safe and reliable operation provided that the following precautions are met:

- To maximize heater element and component life, the temperature must be controlled and maintained within safe operating limits. *Mold-Masters* strongly recommends individual control of each heated component, including heater plates, with a reliable temperature controller that includes soft-start protection.
- Always operate the system using correctly installed "J" type thermocouples connected to a reliable temperature controller with "soft-start" protection.
- Avoid running the system for long periods on "manual" control.
- Use caution when applying power in "manual" mode. Use minimum heat required for the process to avoid overheating and possible damage to components.
- Always replace pinched or damaged thermocouples.
- When "grouping" heated components together and controlling more than one load from a single thermocouple, make sure that the components are of similar material, wattage, size and are exposed to the same thermal conditions.
- When replacing heater plates or other heated components always replace with *Mold-Masters* components of the same type and install as originally specified on *Mold-Masters* general assembly drawings.

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# Section 4 - Preparation

## Introduction

The following section is a step-by-step guide to preparing your *Mold-Masters* system for use.

## Tools Required

Depending on the size and complexity of your hot runner system, you will require most of the tools and materials listed below.

- Allen keys - Depending on system, set of metric or imperial size keys for use on cap screws (4, 5, 6, 8 and 10 mm or imperial equivalent)
- Nickel based anti-seize compound - to prevent oxidation of screw threads that could cause screws to seize with high temperatures
- Solvents (denatured alcohol) - for removal of rust inhibitors
- Calibrated torque wrench - for consistent screw pressure throughout the system
- Pliers - for general assembly work
- Circlip pliers - to remove and install Circlip in valve systems
- Micrometer - (sizes 0-6” and 0-150 mm) to check system part and plate thickness
- Depth micrometer - to check bore depths
- Slot head screw driver - used in installing thermocouples and ground wires
- Slot head screw driver (small) - used in fastening electrical wires to connectors
- Crimping tool - for fastening connector pins when necessary
- Wire strippers - for preparing wires
- Utility knife - for cutting tape, wires etc.
- Glass tape - used for grouping wires into zones
- Bluing Compound - for checking face contact
- Sockets
- Lapping compound for valve gate systems
- Plastic face hammer
- Proper actuator installation / extraction tools

*Figure 4-1*

## Screw Lengths

The use of an incorrect size, length and grade screw could cause the screw to shear, fatigue or stretch beyond its yield point, resulting in expensive downtime of the hot runner.

**WARNING**

Be aware of warnings placed on the assembly drawings. When the manifold is heated the metal expands stretching the mounting screws, if screw lengths are shortened there is a possibility of shearing.

The expansion factor is calculated into the length of each screw size.

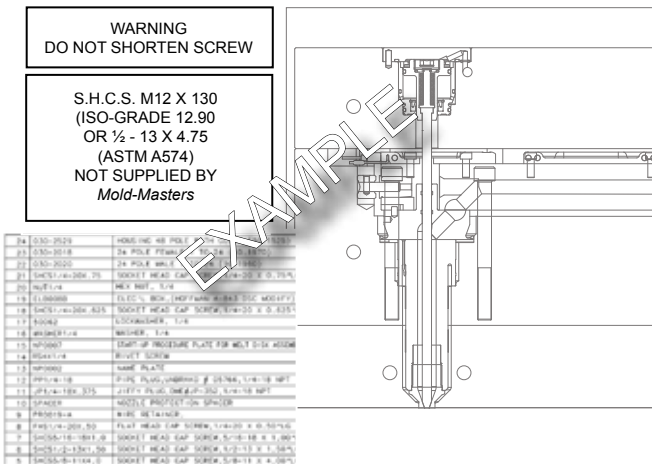


*Figure 4-2*

## Unpacking

1. Carefully remove all components from the shipping box and check that all components listed on the packing slip were supplied.
2. Check that all mold base dimensions are correct and correspond to *Mold-Masters* general assembly drawings.

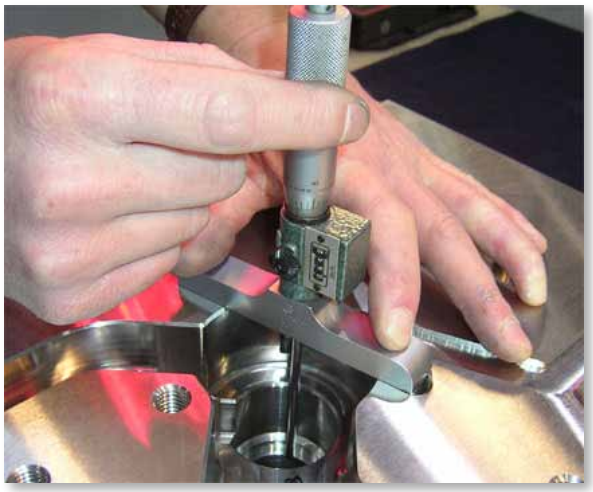

*Figure 4-3*

## Cleaning

All nozzles, manifolds and hot runner components must be free of the rust inhibitor applied at the factory.

1. Disassemble the system.
2. Wipe down the nozzle body.
3. Remove the part and wipe clean.
4. If necessary, use a cotton swab to clean narrow interior surfaces or screw threads. For large surfaces such as mold plates, use thinner in spray form to clean channels and recesses.

*Figure 4-4*

## Establishing Your System Type

The following pages are to be used as a general guide to assist in identifying components. Refer to your general assembly drawings for specific component lists. If your system does not match these systems, please refer to other specialty systems mentioned within the manual for additional information.

## System With Cast In Heater Element

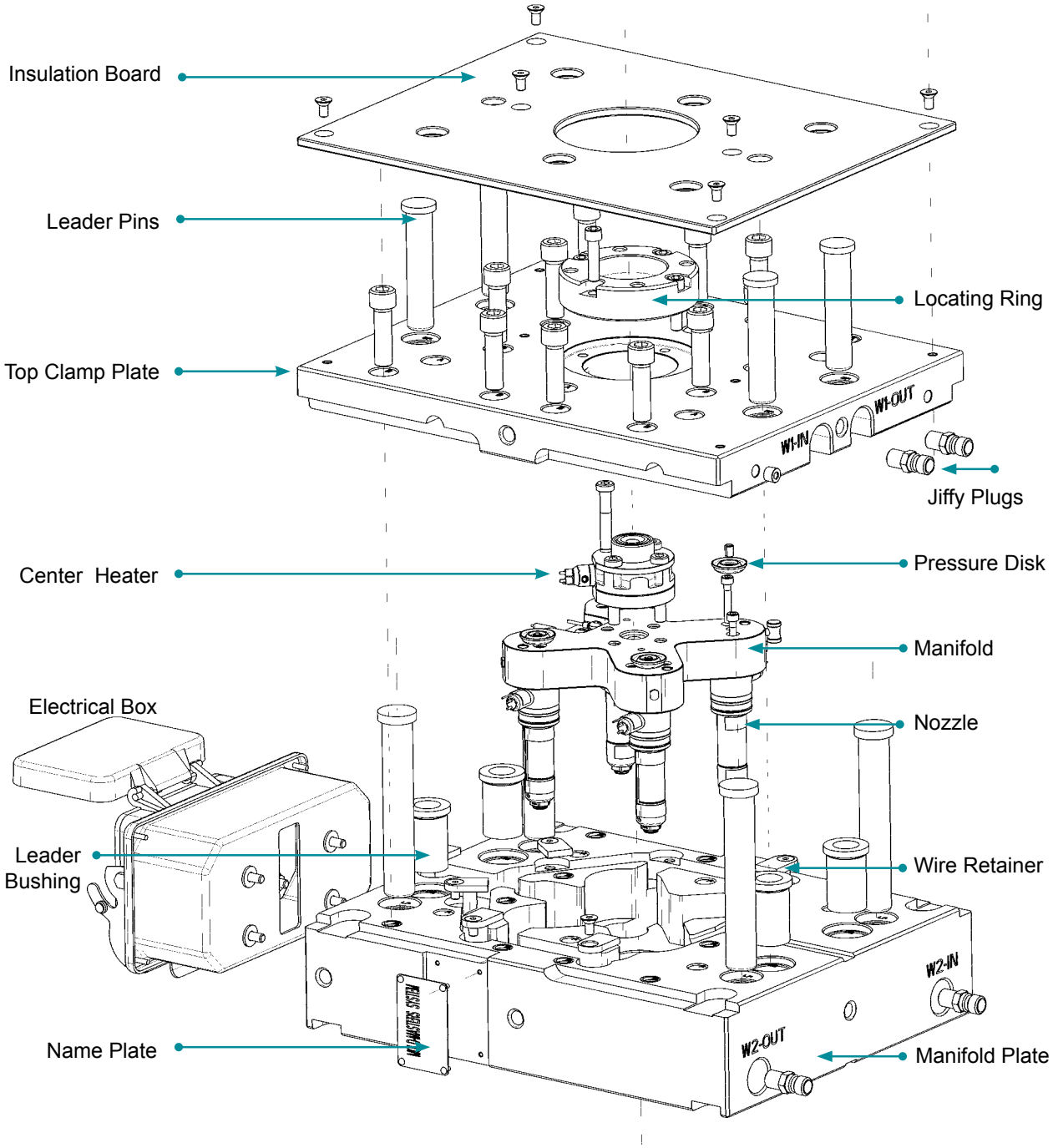


*Figure 4-5*

# System With Hydraulic or Pneumatic Units

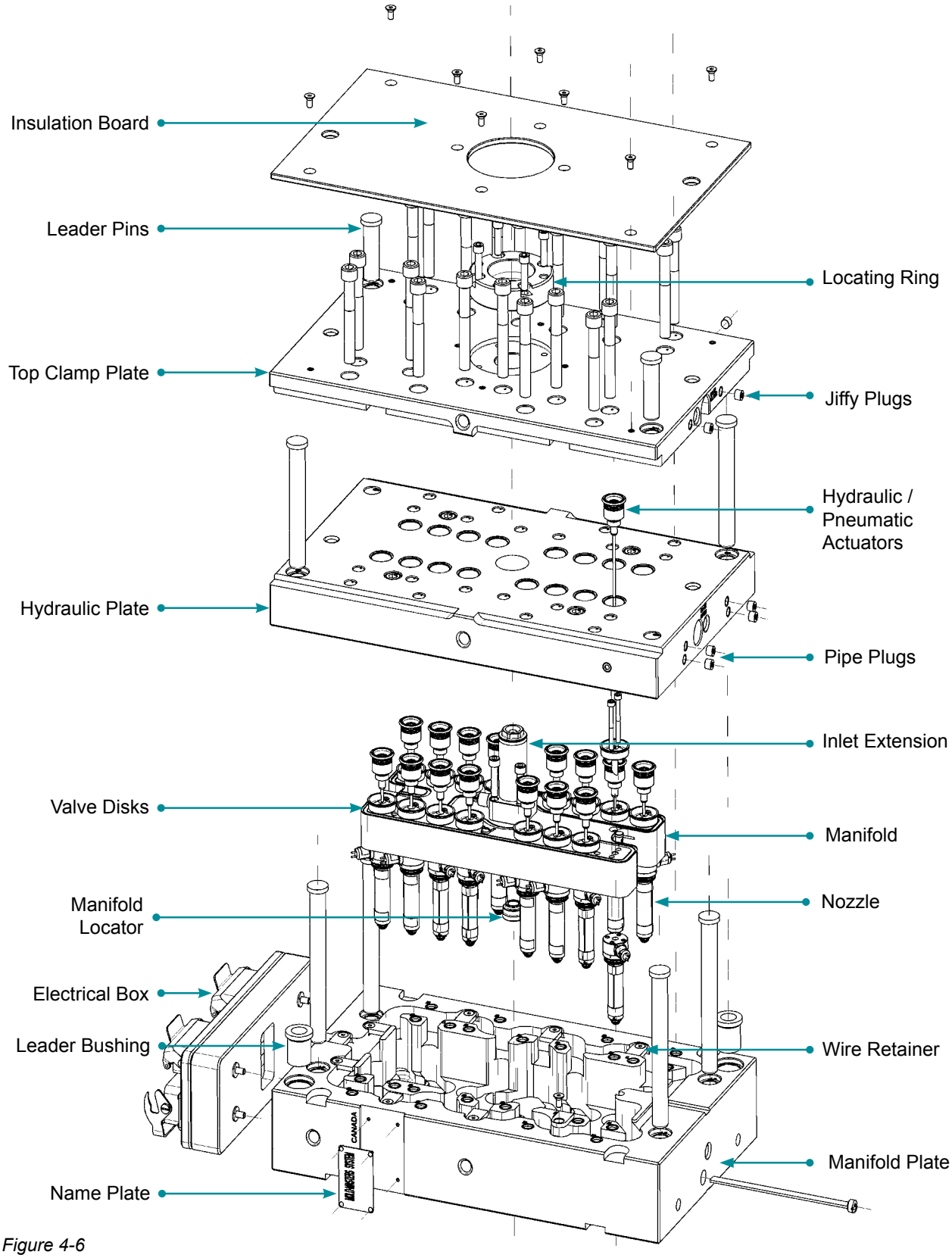


*Figure 4-6*

# System with Bridged Hydraulic Pneumatic System

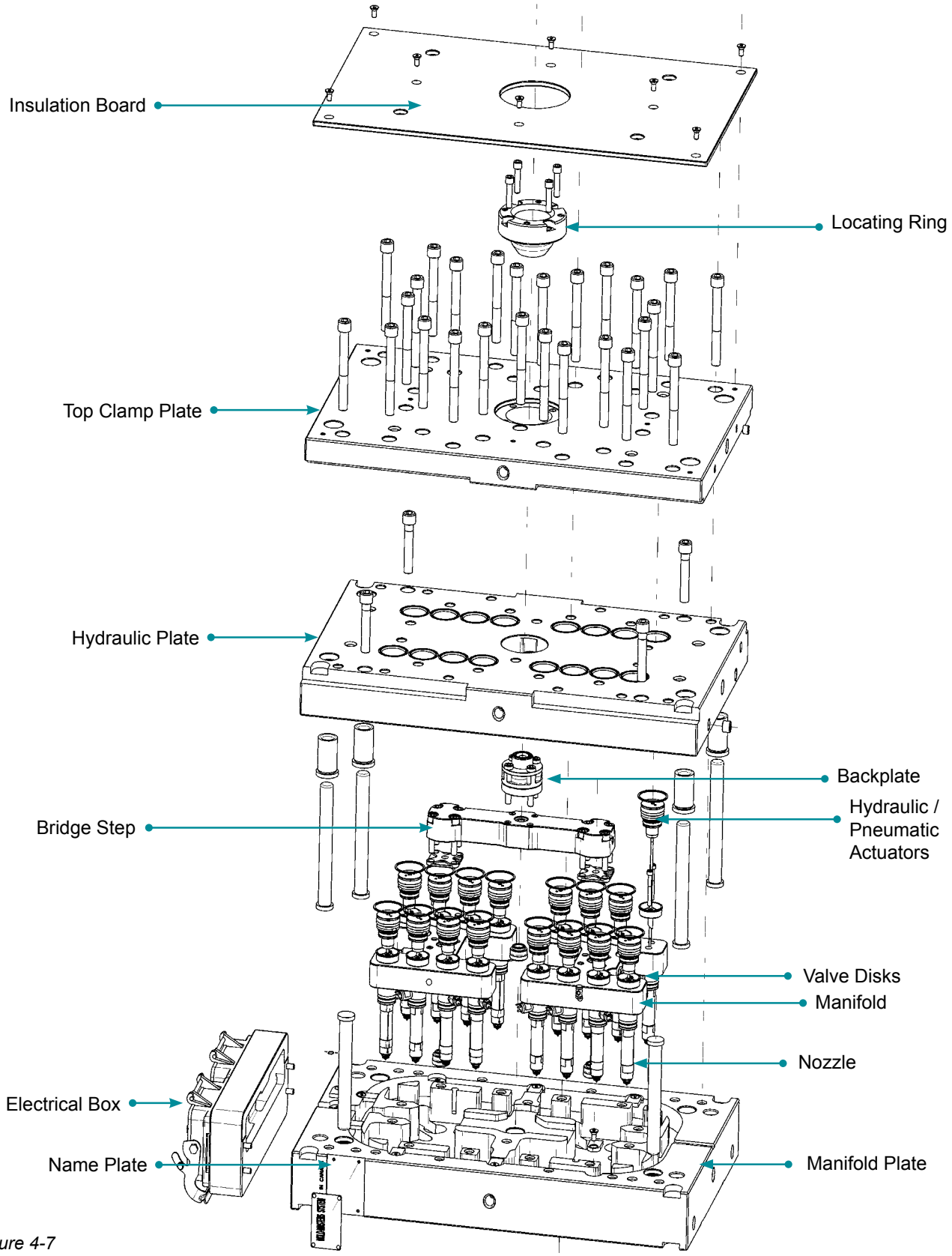


*Figure 4-7*

# Section 5 - Assembly

## Introduction

This section is a step-by-step guide to assembling your *Mold-Masters* hot runner system.

### Cutaway of a “cast-in” system

This illustration of a typical *Mold-Masters* “cast-in” hot runner system is divided into two halves (valve side and non-valve side). The terminology associated with the various components and features are listed below.

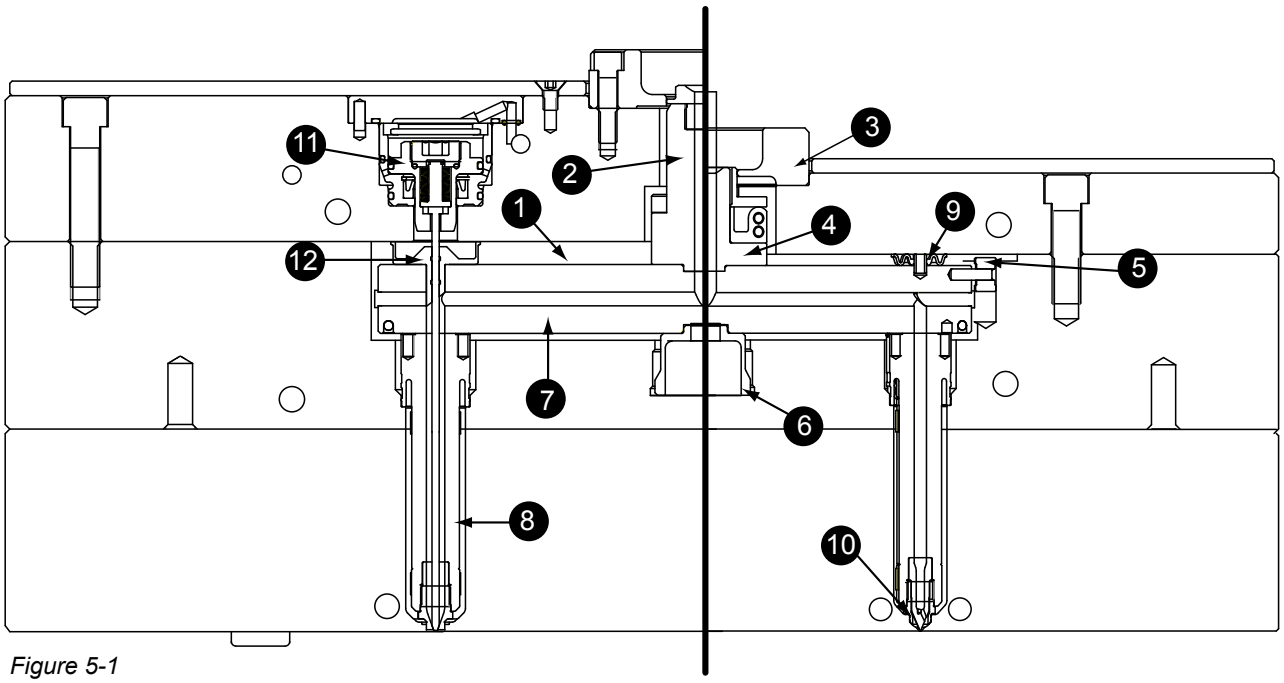


*Figure 5-1*

**1** air gap

**2** inlet extension

**3** locating ring

**4** machine nozzle pad (backplate)

**5** manifold locating cam

**6** manifold locator

**7** “cast-in” manifold

**8** nozzle

**9** pressure disk

**10** gate seal

**11** valve actuator

**12** valve disk

## Cutaway of a “bolt-in” system

This illustration of a typical *Mold-Masters* “bolt-in” hot runner system is divided into two halves (valve side and non-valve side). The terminology associated with the various components and features are listed below.

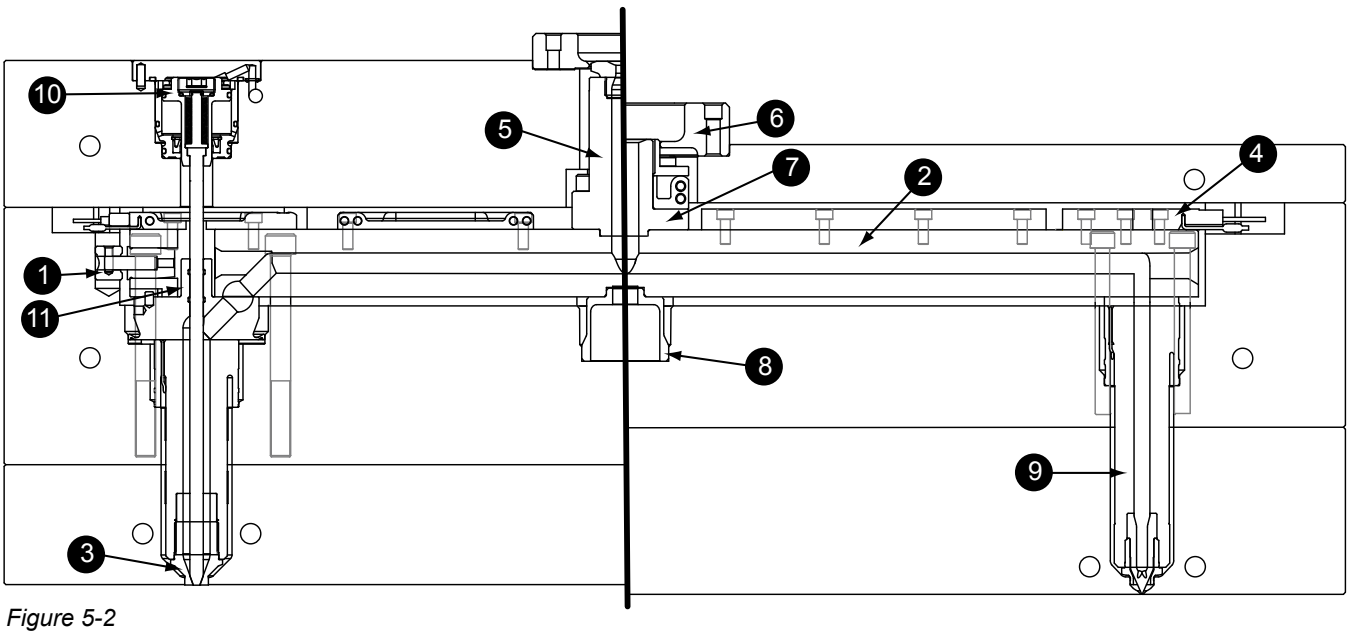


*Figure 5-2*

Valved Non-Valved

**1** manifold locating cam

**2** bolt-in manifold

**3** gate seal/gate insert

**4** heater plate

**5** inlet extension

**6** locating ring

**7** machine nozzle pad (backplate)

**8** manifold locator

**9** nozzle

**10** valve actuator

**11** valve bushing


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## Gate Seal Finishing

Most nozzles are supplied with the gate seal installed (except when the seal requires final machining by a toolmaker, such as the hot valve or hot sprue).

**NOTE**
The gate seals supplied with your system may need to be adjusted to tolerances based on the material grade and cooling in the cavity. Refer to your *Mold-Masters* General Assembly Gate Detail drawing to determine if gate seal finishing is required. Refer to the general assembly drawing to determine which gating method applies.

## Hot Valve / Hot Sprue / F Type

Hot valve and hot sprue gated systems are supplied with gate seals that are oversize in length. They must be machined prior to installing the nozzle into the nozzle well bore.

**NOTE**
A hot sprue also requires completion of the gate detail. Refer to the nozzle well detail drawing.

Heat expansion of the nozzle must be taken into consideration.

Check the chart on the general assembly drawings for the length and contact height required. See contact length "H" on table below.

**CAUTION**
Ensure the thermocouple is not damaged during machining.

| TYPICAL CONTACT LENGTH * | |
|---|---|
| **Polymer Structure** | **Contact Length "H"** |
| Amorphous Filled or Reinforced | 4.00 |
| Semi-crystalline Filled or Reinforced | 3.00 |
| Crystalline Filled or Reinforced | 2.00 |

* Note: Always refer to the General Assembly drawing to confirm the contact length.

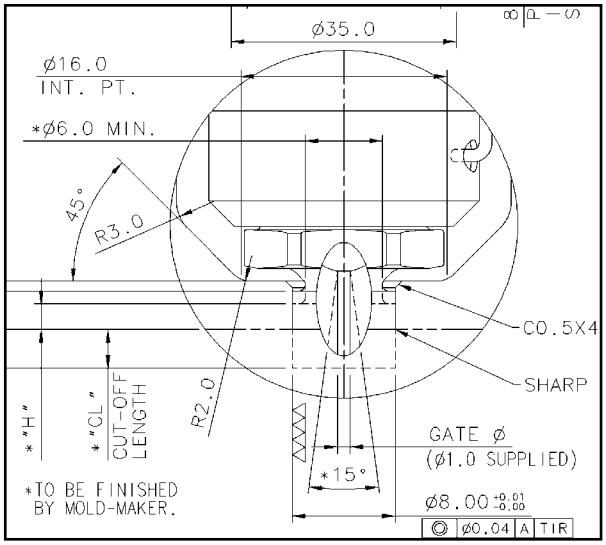


*Figure 5-3 Hot Valve / Hot Sprue Gated System*

## Water-cooled Gate Insert Installation (Option)

Your system may not include a water-cooled gate insert. Refer to your general assembly drawing.

The water-cooled gate insert will require final machining.

1. Machine the water-cooled gate insert to final height and then add the gate detail. Refer to your system drawing for details.
2. Clean the insert-seating bore.
3. Install O-rings onto the water-cooled gate insert.

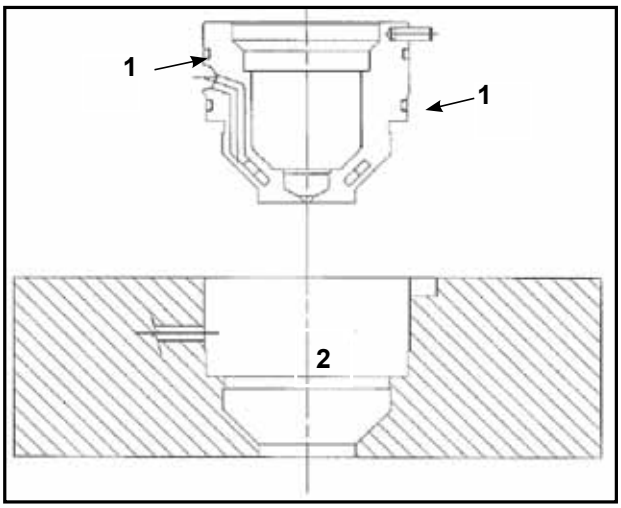


*Figure 5-4 Water-cooled Gate Insert*
*1. O-Rings 2. Seating Bore*

# Master-Series Thermocouple Installation

1. Clean the nozzle thermocouple bore.
   - For 1 mm thermocouples use a #58 drill in a pin vise.
   - For 1.5 mm thermocouples use a 1/16 inch drill in a pin vise.

*Figure 5-5*

2. Insert the thermocouple through the flange bore.

*Figure 5-6a*

*Figure 5-6b*

3. Manually bend the thermocouple tip against your thumb to approximately a 90° angle, ensuring bend length is sufficient to reach the bottom of the termocouple bore.

*Figure 5-7a*

*Figure 5-7b*

4. Dress thermocouple carefully alongside nozzle body and install retaining clip(s). Check parts list for recommended number of clips for the nozzle type. Check that the thermocouple fits into the recess of the clip. It is important that one retainer clip is at the top of the nozzle to keep the thermocouple inside the bore. This is especially important when thermocouples are assembled from the front.

*Figure 5-8*

5. Install the terminal end retaining clip. Check that the thermocouple fits into the recess of the clip.

**CAUTION**
Ensure the terminal end of the thermocouple stays fully engaged in the slot while bending the thermocouple at the nozzle flange area.

*Figure 5-9*

6. Install the clip over the terminal end.

*Figure 5-10*

7. Use heat resistant tape to secure the nozzle wires and thermocouple wires just above or below the insulator pod.

*Figure 5-11*

## Master-Series Thermocouple Removal

(for non-front mounted thermocouples)

**CAUTION**
Removing thermocouples will damage them and is not recommended unless replacing a damaged thermocouple with a replacement one.

1. Remove the thermocouple from the electrical box and wire channels.
2. Remove the nozzle from the manifold plate.
3. Remove the thermocouple retaining clips.
4. Remove the thermocouple.

## Dura Line Thermocouple Installation

*This page only applies to Legacy Dura Nozzles.*

*Mold-Masters* Dura systems are supplied with an appropriate bending tool. Any questions regarding bending tools, please contact your *Mold-Masters* representative. Make sure that correct bending tool is used. Each different type of Dura nozzle requires a different bending tool. The correct bending tool was supplied with your hot runner.

1. Clean nozzle thermocouple bore.

*Figure 5-12*

2. Place thermocouple through the flange of the nozzle.

*Figure 5-13*

3. Place the end of the bending tool all the way over the end of the thermocouple. While supporting the thermocouple, create a 180° “fish hook” with the tool. Make sure the bending tool is snug up against the thermocouple.

*Figure 5-14*

4. Insert the bent thermocouple end into the nozzle mating hole and make sure it is fully engaged.

*Figure 5-15*

5. Make sure the thermocouple is fully engaged in the nozzle body while bending the thermocouple at the flange.

*Figure 5-16*

6. Press thermocouple downwards to sit against terminal end and secure to side of terminal end with heat resistant tape to ensure it does not become pinched between the nozzle and the manifold.

*Figure 5-17*

7. Use heat resistant tape to secure the nozzle wires and thermocouple wires just above or below the insulator pod. The nozzle is ready for assembly with the thermocouple fully installed.

*Figure 5-18*

## Nozzle Insertion

**NOTE**
Prior to commencing assembly verify manifold and nozzle cutouts in mold plates are to specification to ensure proper clearance to hot runner. Improper clearance will affect system performance.

1. Clean the nozzle well seating bore.
2. Install the nozzle.

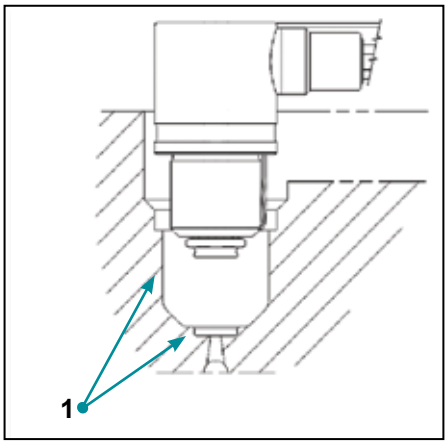


*Figure 5-19 Nozzle Well Cleaning*

**CAUTION**
Systems with gate seals that are not accessible when fully assembled require the gate seals to be torqued hot prior to installation.

The mold plate needs to be in horizontal position when inserting nozzles. Care must be taken when handling the nozzles.

For liner systems, damage to the tip of a nozzle can result in gate vestige. Special care must be take with F-type, Hot Sprue and Hot Valve gating styles, where the transfer seal goes up into the part cavity. In these cases care is needed to prevent damage to the sharp edge of the gate seal and gate seal receiving bore.

3. Check that Face 1 is at the same level for all drops relative to the mold plate split line.

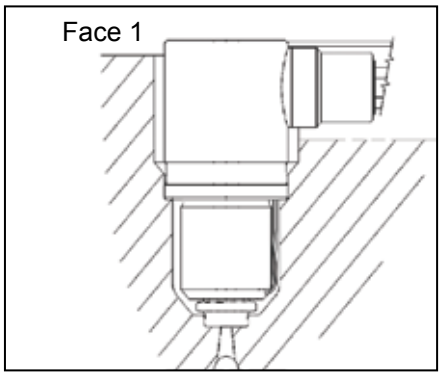


*Figure 5-20*

4. Check that nozzle sits squarely in nozzle well bore.

## Nozzle Wire Layout

### Back Mounted Thermocouples

1. Place a zone number on each wire and thermocouple.
2. Try to organize and tape wires by zone and plug.
3. Install the wires into the wire channels and secure with wire retainers.
4. Feed the wires back through the wire channel in the mold base to the electrical box. Do not cut the wires until the remaining components are installed.

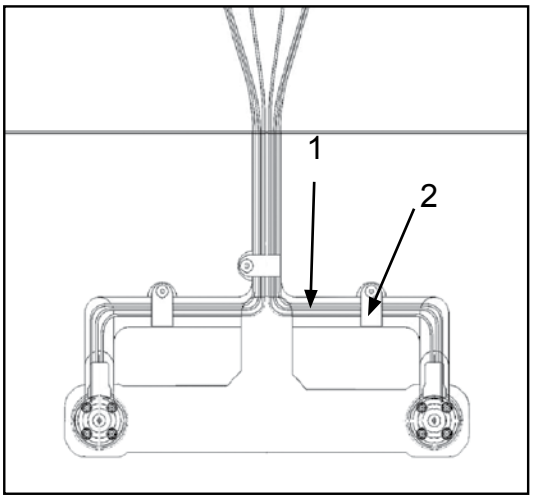


*Figure 5-21 Wiring Layout*
*1. Wire Channel 2. Retainers*

### Front Mounted Thermocouples

1. Place a zone number on each wire and thermocouple.
2. Try to organize and tape wires by zone and plug.
3. Install the wires into the wire channels and secure with wire retainers.
4. Feed the wires back through the wire channel in the mold base to the mold plug. Do not cut the wires too short. Leave sufficient wire for future maintenance and ease of access.

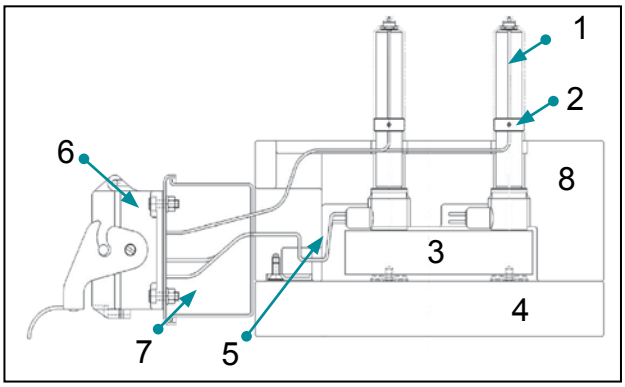


*Figure 5-22 Thermocouple Layout - Side View*
*1. Thermocouple 2. Wire Retainer*
*3. Manifold 4. Manifold Backing Plate 5. Power Wire*
*6. Mold Plug 7. Electrical Box 8. Manifold Plate*

## Valve Bushings

### Types of Valve Bushings

- Heated
- Non-Heated

*Figure 5-23 Valve Bushing Types*
*1. Non-Heated 2. Heated*

### Valve Bushing Installation

This procedure applies to valve gated systems that are bolt-in design. Refer to the parts lists and your general assembly drawing to determine if your system has a valve bushing.

1. Mount the valve bushing on top of the nozzle.

**NOTE**
The valve bushing for *Accu-Valve* has a locating dowel pin with the mold.

2. Install the locating dowel. Ensure the dowel pin is not too long as this will effect the seal between the nozzle and the manifold.

**WARNING**
If required, attach a crane of sufficient lifting capacity to the manifold. Make sure the lifting eyebolt, chain and crane can support the weight of the manifold. Failure to do somay cause serious injury.

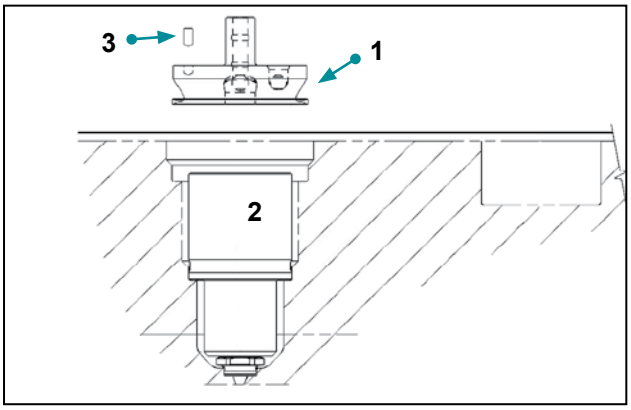


*Figure 5-24 Valve Bushing*
*1. Valve Bushing 2. Nozzle 3. Locating Dowel*

3. Apply anti-seize on the threads of each screw.
4. Lower the manifold into position.

**WARNING**
Ensure the dowels are in the correct positions.

5. Install screws through the manifold and into the manifold plate (the mounting screw thread must start at the flange seal level). Refer to the GA drawings for correct screw size.
6. Torque screws to value indicated on the general assembly drawing and secure manifold to the manifold plate.

**NOTE**
On bridge manifold systems, main to sub-manifold screws should be torqued 1/3 higher than specified on general assembly drawings.

**WARNING**
Do not shorten the screw length.

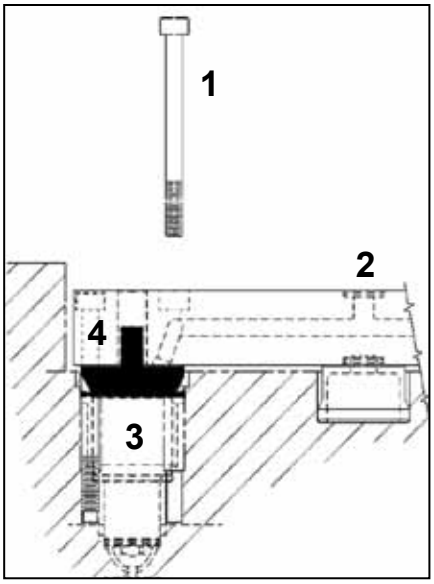


*Figure 5-25 Valve Bushing Installation*
*1. Mounting Screw 2. Manifold*
*3. Nozzle 4. Valve Bushing*

# Mounting the Manifold

## Introduction

There are three methods used to locate the manifold:

1. Manifold Locator
2. Dowel Pin Locator
3. Manifold and Slot Locator

## Manifold Locator

**NOTE**
Check GA drawing for information for your system.

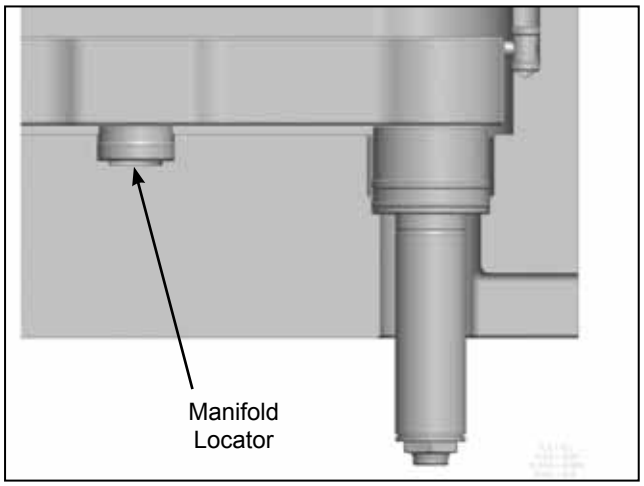


*Figure 5-26 Manifold with a Locator*

1. For some systems locators are supplied oversize (X) and must be ground to the same level as the top of the nozzles. Remove the material from the bottom face of the locator (FACE Y). This will allow SURFACE (A) and SURFACE (B) to be at the same level in the cold condition. **However, check the GA drawing for exception notations.**

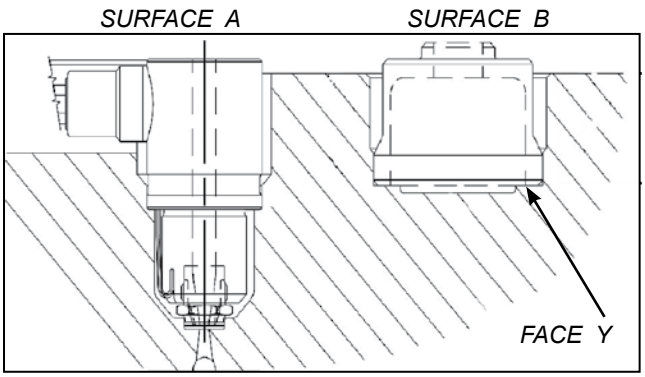


*Figure 5-27 Locator Surface*

2. Blue the manifold locator into the bore to ensure proper seating.
3. Install the locating cam dowel pin.
4. Install the locating cam onto the dowel pin.

**WARNING**
Make sure the lifting eyebolt, chain and crane can support the weight of the manifold. Failure to do so may cause serious injury.

5. If required, attach a crane of sufficient lifting capacity to the manifold.
6. Check for correct seating and height.
7. Check that there are no pinched wires.

## Manifold Locating Dowel Pin

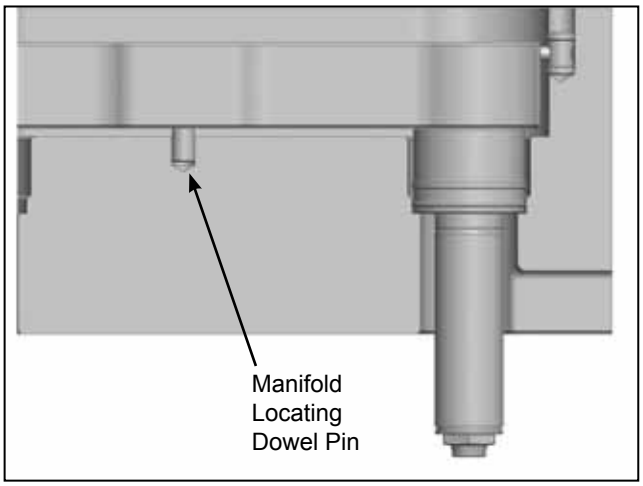


*Figure 5-28 Manifold Locating with a Dowel Pin*

1. Install the dowel pin into the mold.
2. Check that the dowel pin does not touch the top of the manifold.
3. Install the locating cam dowel pin.
4. Install the manifold locating cam onto the dowel pin. If required, attach a crane of sufficient lifting capacity to the manifold.
5. Place the manifold on top of the nozzles and locating dowel.
6. Check for correct seating and height.
7. Check that there are no pinched wires.

## Manifold and Slot Locator

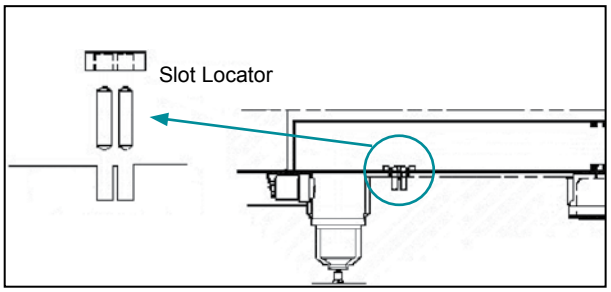


*Figure 5-29 Manifold with Slot Locator*

1. Blue the manifold locator into the bore to ensure proper seating.
2. Install the slot locator into the mold. Ensure sufficient gap between the slot locator and the manifold slot top surface. Under no circumstances should they touch.
3. If required, attach a crane of sufficient lifting capacity to the manifold. Place the manifold on top of the nozzles and manifold locator.
4. Check for correct seating and height.
5. Check that there are no pinched wires.

## Installing the Manifold Thermocouple

This procedure only applies to integrated systems.

1. Although not necessary, a thermal compound may be applied to the thermocouple tip to ensure a good contact.
2. Clean the thermocouple bore. Suggestion for 1.5 mm thermocouples is to use a 1/16 inch drill in a pin vise.
3. Insert the thermocouple into the bore. Check that the thermocouple is touching the bottom of the hole.
4. Press down on the thermocouple and gently bend the thermocouple sheath through 90°.
5. Check that the thermocouple sits in the manifold cutout.
6. Install the thermocouple washer and screw.
7. Install a zone number on each wire and thermocouple.
8. Tape wires for each zone together.
9. Install the wires into the wire channels and secure with wire retainers.
10. Feed the wires back through the wire channel in the mold base to the electrical box.

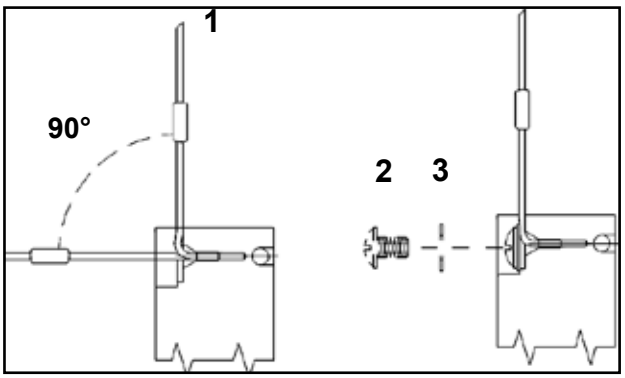


*Figure 5-30a Thermocouple Installation*
*1. Thermocouple 2. Screw 3. Washer 4. Assembly*

*Figure 5-30b*

# Main Manifolds

Manifolds distribute melt from the inlet component to one or more sub-manifolds. If you have a sub manifold configuration, follow these instructions. This system will have one of two configurations for inlet seals.
Refer to the general assembly drawing to determine which applies.

- Inlet seal without step
- Inlet seal with step

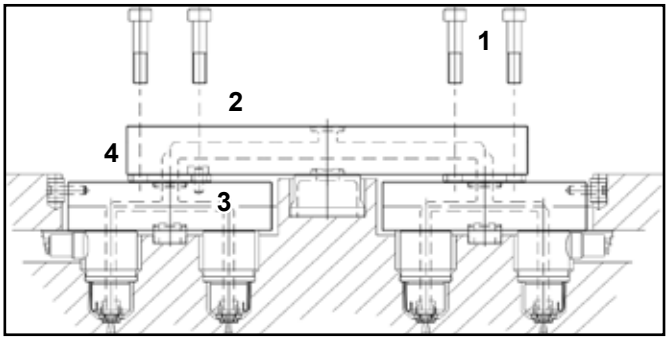


*Figure 5-31 Install Main Manifold*
*1. Mounting Screws 2. Main Manifold 3. Dowel Pin 4. Inlet Seal*

## Inlet Seal Installation (without step)

Manifolds that use a seal without a step:

1. Place the inlet seal into all sub-manifold inlets.
2. Check that the inlet seal orientation is chamfer down.
3. Check that all inlet seal heights are at the same level.
4. Install the manifold locators. Refer to "*Mounting the Manifold*".
5. Check that all components are free of debris.

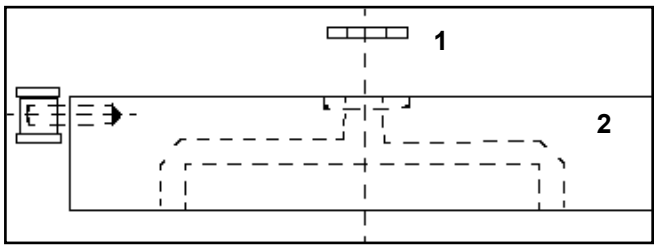


*Figure 5-32 Inlet Seal without Step*
*1. Inlet Seal 2. Sub-Manifold*

## Inlet Seal Installation (with step)

Manifolds that use inlet seals with a step:

1. Install the step inlet seal to the manifold.
2. Install the dowel pin into the seal and manifold.
3. Lower the main manifold into position.
4. Install manifold mounting screws and torque to required settings.
5. Refer to your general assembly drawing for specifications.
6. Install the manifold thermocouples. Refer to "*Installing the Manifold Thermocouple*".

**NOTE**
On bridge manifold systems, mounting screws should be torqued 1/3 higher than specified on general assembly drawings.

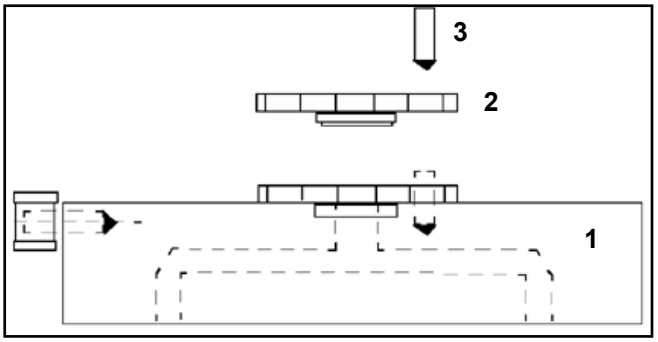


*Figure 5-33 Inlet Seal with Step*
*1. Sub-Manifold 2. Inlet Seal 3. Locating Dowel*

## Installing the Pressure Disk / Valve Disk

Review your parts list and general assembly drawing to determine the feature installed in your system.

- Pressure Disk - is compressed by thermal expansive forces to form part of the plastic sealing mechanism. This also helps to reduce thermal transfer to a minimum. These may, or may not, require grinding.
- Valve Disk - is compressed by thermal expansive forces to form part of the plastic sealing mechanism. It's high tolerance bore allows the valve pin to shift through it without plastic leakage and part of it enters the melt stream and helps guide the plastic flow without stagnation. These may, or may not, require grinding.

For additional information please refer to "*Establishing Your System Type*".

## Pressure Disk - Final Grinding Required

This type of pressure disk is supplied oversize in height and requires grinding to dimensions specified on the general assembly drawing.

Pressure disk or valve disk height = Pocket depth - (Manifold thickness + Nozzle flange + Air gap)

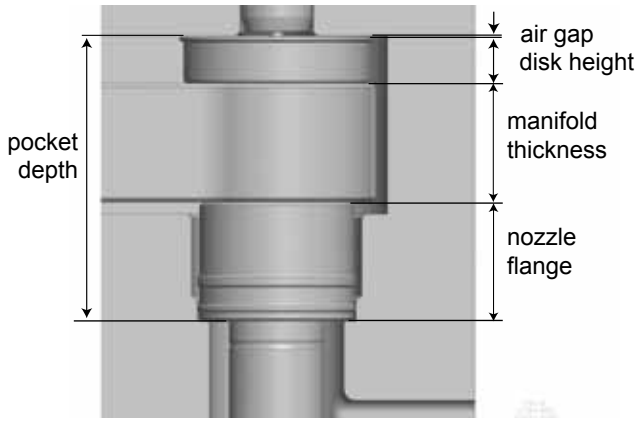


*Figure 5-34 Calculating Pressure Disk / Valve Disk Height*

### Calculate Pressure Disk Height

1. Calculate the following dimensions at ambient (room) temperature:
   a. Measure the depth of the nozzle bore “a” from the top of the manifold plate to the nozzle support base.

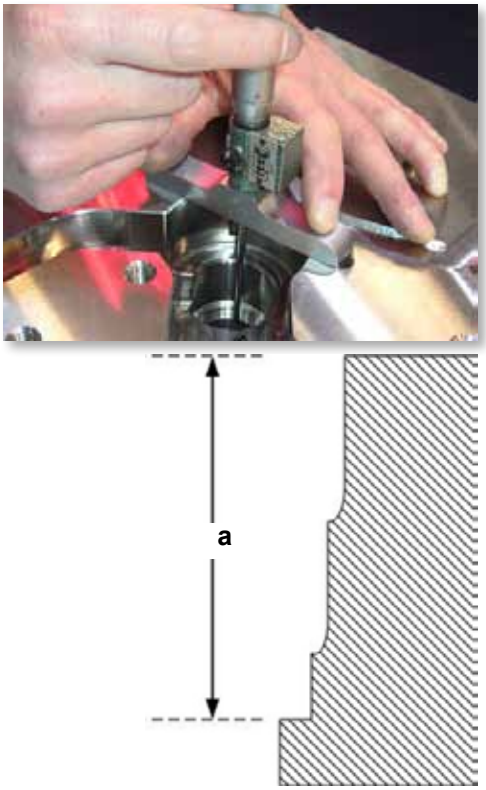


*Figure 5-35 Calculating Nozzle Bore Depth "a"*

   b. Measure the top section of the nozzle flange “b”.

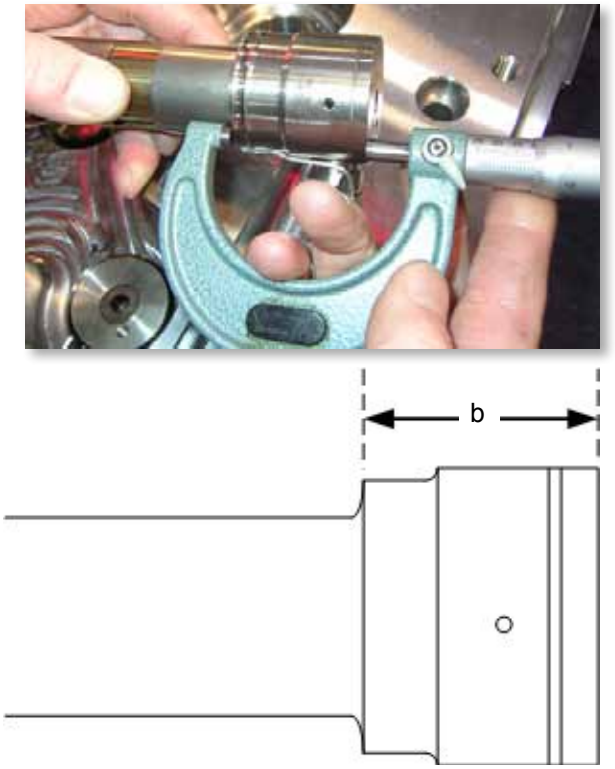


*Figure 5-36 Calculating Nozzle Flange Height "b"*

   c. Measure the manifold thickness “c”.

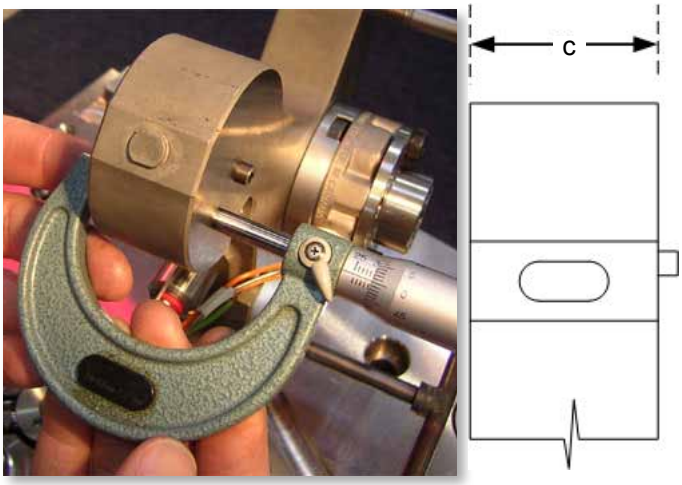


*Figure 5-37 Calculating Manifold Thickness "c"*

2. Calculate **Pressure Disk height "d" = a – b – c – air gap**.
   This is the value ("d") that is required for correct assembly. Refer to the general assembly drawing for reference values, such as the air gap.
3. The actual height (thickness) of the supplied pressure disk "e" will be of a value that's higher than the value "d". Calculate the difference, and then divide by 2. This is the value that will need to be ground from each side of the pressure disk.

   Example Calculations
   Nozzle pocket depth "a": 91.39 mm
   Nozzle flange height "b": 43.16 mm
   Manifold thickness "c": 43.16 mm
   Air gap as noted on drawing: 00.05 mm
   Pressure disk height "d": 91.39 - 43.16 - 43.16 - 0.05 = 5.02 mm
   Supplied pressure disk "e": 5.10 mm
   Difference between supplied pressure disk "e" and required pressure disk "d": 5.10 mm - 5.02 mm = 0.08 mm
   Material to be removed from each side of the pressure disk: 0.08mm ÷ 2 = 0.04 mm
   Nozzle bores and pressure disks must be within tolerances specified in the general assembly drawing.

## Pressure Disk Installation

1. Install the manifold to the nozzle.
2. Refer to the general assembly drawing for pressure disk dimensions before calculating the pressure valve disk height.
3. Grind equal amounts from each side of the pressure disk to give 0.00 to 0.025mm cold clearance and retain maximum strength of the 'V' form. Some systems require a larger air gap, refer to the general assembly drawing.
4. Remove the sharp corners after grinding and clean the disk well to ensure no grinding dust remains on the disk.

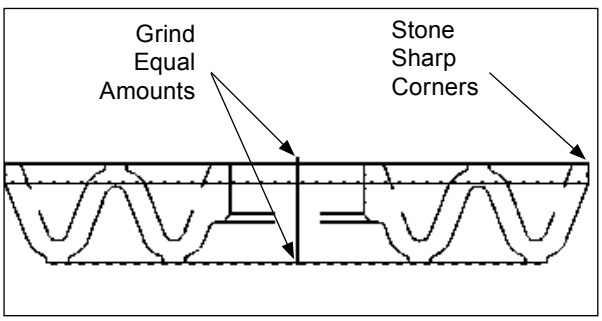


*Figure 5-38*

5. Install the pressure disk spring dowel to the manifold.
6. Install the pressure disk to the manifold.

### Pressure Disk - Final Grinding Not Required

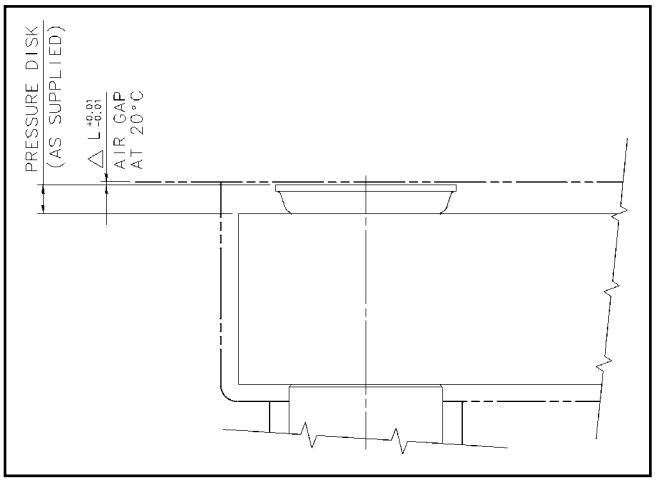


*Figure 5-39 Optional Pressure Disk Mounting Detail (Without Final Grinding)*

**Alternate Method -** Air gap adjustment from top clamp or hydraulic plate.

1. Calculate and machine the nozzle bore seat with additional air gap value. (Example: Flange height + Manifold height + Pressure disk height + Air gap value)
2. Install the nozzle into the manifold plate.
3. Install the manifold to the nozzle.
4. Refer to the general assembly drawing for pressure disk locations.
5. Measure the gap between the top of the manifold plate and the top of the pressure disk. Ensure that it matches the air gap value on the general assembly drawing.

### Valve Disk - Final Grinding Required

These valve disks are supplied oversize in height and require grinding to dimensions specified on the general assembly drawing before calculating the pressure valve disk height.

1. Grind the valve disk **on top side only.**
2. Remove sharp corners after grinding and clean the valve disk, especially inside the valve pin bore.

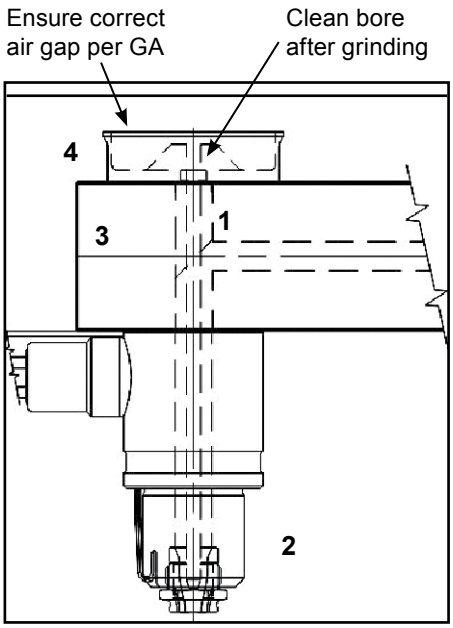


*Figure 5-40a Manifold to Nozzle Mounting*
*1. Spring Dowel 2. Nozzle 3. Manifold*
*4. Valve Disk*

3. Install the manifold to the nozzle.
4. **For 1-Pc Valve Disk** - Install the valve disk in appropriate orientation.

   **For 2-Pc Valve Disk** - Insert valve stem into the manifold in appropriate orientation. Slide valve flange over the stem. (see Figure 5-33b).

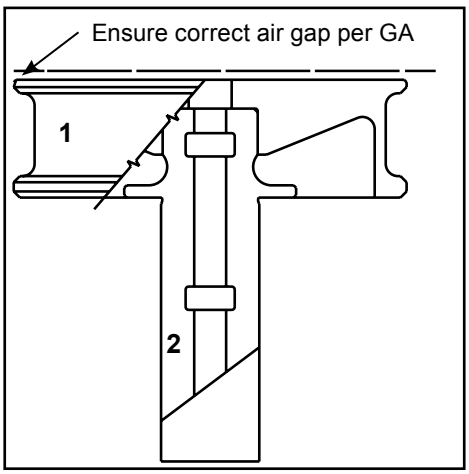


*Figure 5-40b 2 Pc Valve Disk 1. Valve Disk Flange 2. Valve Disk Stem*

5. Ensure correct air gap between the valve disk and the top plate, as specified in the GA drawing.
6. For information on removal, refer to Valve Disk Removal, within the Maintenance Procedures section.

**Alternate Method -** Air gap adjustment from top clamp or hydraulic plate

1. Calculate and machine the nozzle bore seat with additional air gap value. (Example: Flange height + Manifold height + Valve disk height + Air gap value)
2. Install the nozzle into the manifold plate.
3. Install the manifold to the nozzle.
4. Refer to the general assembly drawing for valve disk locations.
5. Measure the gap between the top of the manifold plate and the top of the valve disk. Ensure that it matches the air gap value on the general assembly drawing.

## Installing Heater Plates

These procedures apply to systems with external heater plates. Refer to the general assembly drawing to determine which heater plate applies to your system.

**NOTE**
Current bronze heater plates are directly interchangeable with previous copper or aluminum based plates that may exist on your *Mold-Masters* system. However, when multiple heater plates are controlled by one thermocouple, these heater plates must be made of the same material, of equal wattage and are located in similar thermal environments.

**CAUTION**
Heater plates are controlled by a thermocouple located in the heater plate. Do not control the heater plate from a thermocouple in the manifold.

1. Clean the thermocouple bore. Suggestion for 1.5 mm thermocouples is to use a 1/16 inch drill in a pin vise.
2. Insert the thermocouple into the bore. Ensure the thermocouple is touching the bottom of the bore hole.
3. Press down on the thermocouple and gently bend to 90°.

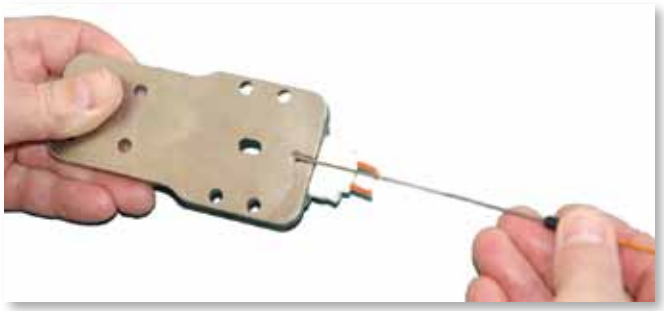

*Figure 5-41 Heater Plate and Thermocouple*

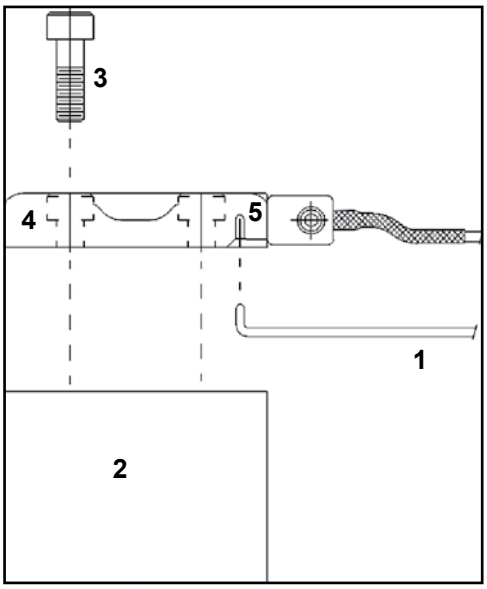


*Figure 5-42 T/C Installation*
*1. Thermocouple 2. Manifold*
*3. Mounting Screw 4. Heater Plate*
*5. Thermocouple Bore Hole Plate*

4. Install the heater plate to the manifold. Refer to the general assembly drawing for location.

**CAUTION**
This is a pinch point area. Use caution when installing the heater plate to the manifold plate. Failure to do so could result in damage to the thermocouple.

5. Secure the heater plate to the manifold. Use anti-seize on threads.

**CAUTION**
Do not over-tighten the mounting screws. This could result in the heater plate losing contact with the manifold plate. Refer to the general assembly drawing for the correct torques. It is recommended that the heater plate wires be isolated and grouped so that they do not have to be disconnected if the manifold needs to be dismantled for repair.

6. The heater plates are supplied with the power wires connected. Place a zone number on each wire and thermocouple.
7. Tape wires for each zone together.
8. Install the wires into the wire channels and secure with wire retainers.
9. Feed the wires back through the wire channel in the mold base to the electrical box.

## Installation of Inlet Components

The following procedures refer to different system configurations. Refer to your parts list and general assembly drawings to determine your system type.

**CAUTION**
For all inlet components it is important that the mold locating ring is touching the inlet component just enough for sealing the area. This should be doubled checked with the system drawings.

### Back Plate Installation

1. Check the machine nozzle radius.
2. Check the seating on the bottom face of the back plate and manifold.
3. Install the back plate onto the manifold.

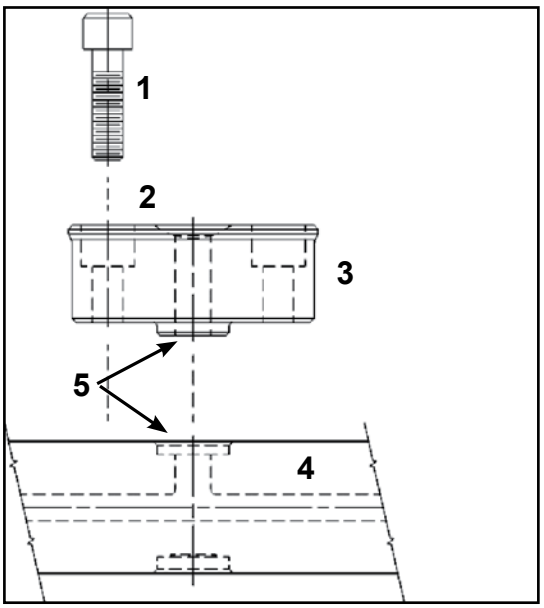


*Figure 5-43 Back Plate Installation*
*1. Mounting Screw 2. Nozzle Radius*
*3. Back Plate 4. Manifold 5. Bottom Face*

4. Install M8 mounting screws through the back plate to the manifold using anti-seize on threads.
5. Torque screws to value indicated on the GA drawing in a cross pattern, in 5 ft/lb increments.

**NOTE**
The machine nozzle bore should be no smaller than 1.0mm (0.040”) smaller than the back plate bore and no larger than the back plate bore.

## Center Heater Installation

The center heater may require the machine nozzle radius to be added.

1. Place the center heater on the manifold.
2. Rotate the center heater to align with the tapped holes in the manifold and align terminals with cut out.
3. Install mounting screws through the center heater into the tapped holes of the manifold. Use anti-seize on the screws.
4. Torque screws to values indicated on the general assembly drawing.
5. Place zone number on each wire and thermocouple.
6. Tape wires for each zone together.
7. Install the wires into the wire channels and secure with wire retainers.
8. Feed wires back through the wire channel in the mold base to the electrical box.

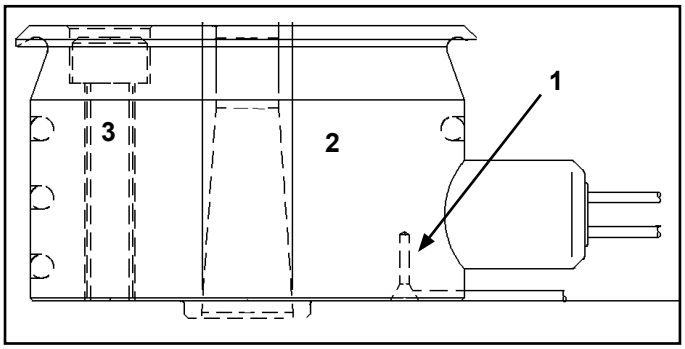


*Figure 5-44 Center Heater Assembly*
*1. Thermocouple 2. Center Heater 3. Screw*

## Three Piece Center Heater Installation

1. Install the back plate on the manifold.
2. Mount the center heater on back plate.
3. Although not necessary, a thermal compound may be applied to the thermocouple tip to ensure a good contact.
4. Install the thermocouple.
5. Install the cover plate.
6. Install M8 mounting screws through the cover plate into the tapped holes of the manifold. Use anti-seize on screws.
7. Torque screws to values indicated on the general assembly drawing.

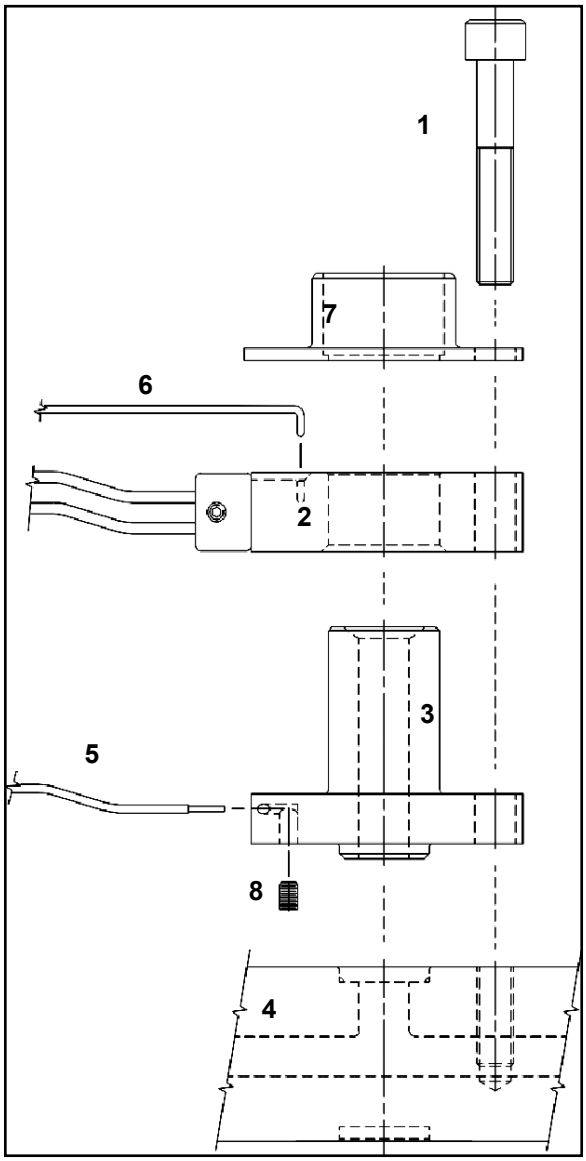


*Figure 5-45 3 Piece Assembly*
*1. Screw 2. Center Heater 3. Back Plate 4. Manifold 5. Ground Wire 6. Thermocouple 7. Cover Plate 8. Set Screw*

## Inlet Extension Installation

1. Place the inlet extension on the manifold.
2. Install mounting screws through the nozzle flange and into the manifold.
3. Torque screws to manifold using anti-seize on threads.
4. Place a zone number on each wire and thermocouple.
5. Tape wires for each zone together.
6. Install the wires into the wire channels and secure with wire retainers. Feed the wires back through the wire channel in the mold base to the electrical box.

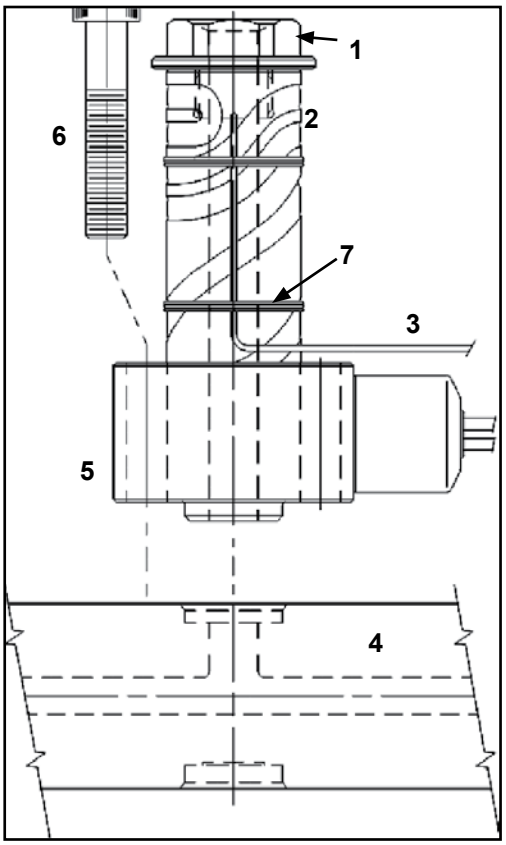


*Figure 5-46 Inlet Extension*
*1. Extension Tip 2. Inlet Extension 3. Thermocouple 4. Manifold 5. Nozzle Flange 6. Screw 7. Wire wrap*

## Inlet Extension with Pressure Sleeve

**CAUTION**
Always install the inlet extension, pressure sleeve, clamp plate and locating ring with the mold plates in the horizontal position. Failure to do so could result in damage to the components and cause material leakage.

1. Place the inlet extension on the manifold.
2. A pressure sleeve is supplied oversize in length. Refer to general assembly drawing to determine length of pressure sleeve.
3. Cut the inlet extension pressure sleeve to the required height.
4. Chamfer the outside edge of the pressure sleeve.
5. Place zone number on each wire and thermocouple.
6. Tape wires for each zone together.
7. Install the wires into the wire channels and secure with wire retainers.
8. Feed the wires back through the wire channel in the mold base to the electrical box.
9. For electrical checks, refer to the Electrical Testing section.

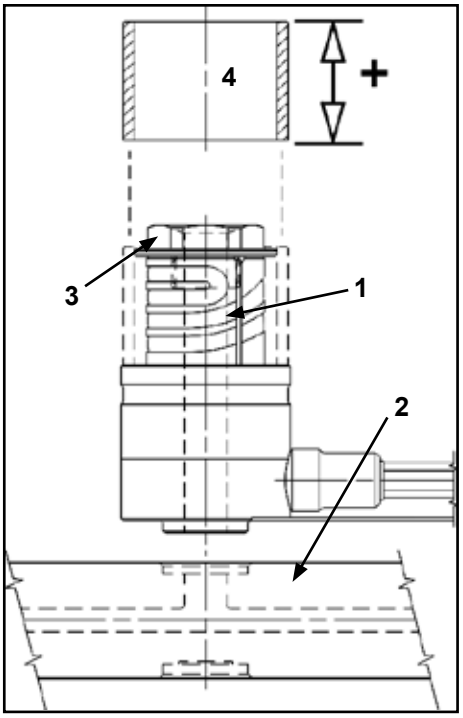


*Figure 5-47 Inlet Extension with Sleeve*
*1. Inlet Extension 2. Manifold*
*3. Extension Tip 4. Pressure Sleeve*

# Section 6 - Electrical Testing

## Introduction

This section contains guidelines for electrical testing of your *Mold-Masters* hot runner system. The testing is based on the following European and North American standards:
EN 60204-1 / DIN EN 60204-1 (IEC 60204-1, modified) Safety of machinery - electrical equipment of machines
NFPA 79 Electrical Standard for Industrial Machinery
The standards themselves are the final authority for testing requirements (also any additional testing requirements from any national standards where the hot runner is in use).

**WARNING**
The user is responsible to ensure protection against shock by indirect contact, by protective earth conductors and automatic disconnection of supply. *Mold-Masters* components and systems are either equipped with a protective earth conductor or there is a connector for this purpose.

**WARNING**
To avoid serious burns wear safety clothing consisting of a protective heat-resistant coat, heat-resistant gloves and a full face shield over safety glasses. Use adequate ventilation for fumes.

Contact with heated components may cause serious burns. Use a sign in a visible location indicating “Danger: Do Not Touch”.

Before you carry out electrical work, make sure that the hot runner system is securely grounded. Turn the temperature control off and disconnect all electric wires coming from the mold. Failure to follow of these steps may lead to serious injury or death.

## Wiring Check

**WARNING**
Ensure that all wiring and connection work is performed by a qualified electrician according to DIN EN 60204-1 / NFPA79.

1. Check that each wire and thermocouple has a zone number.
2. Check that wires are organized and taped together by zone and plug.
3. Check all wires are secured in wire channels.
4. Connect all power leads and thermocouple wires to mold plugs.
5. The electricity mains should only be connected to the injection mold when all electrical connections are grounded and the mold is closed.

**WARNING**
A disassembled nozzle should only be connected to an electrical supply when the nozzle has been grounded or a safety isolating transformer is used.

## Electrical Safety Testing

Electrical safety tests shall be performed according to DIN EN 60204-1, paragraph 18 and NFPA79. Testing guidelines are given below, however, the standards identified earlier in the introduction are the final authority.

### Verify Equipment to its Technical Documentation

First, verify that the electrical equipment complies with its technical documentation.

### Insulation Resistance Test

Measure the insulation resistance between each pin of the *Mold-Masters* power connector, in particular the heating circuit and ground.

The insulation resistance is measured at a DC voltage of 500V. The insulation resistance must not be less than 1 MΩ.

If this value is not reached when heating, the cause is often moisture inside the heating element, which should be removed using a control unit equipped with this function.

Where a mold has not been in use for several weeks or months, it should be re-tested.

### Verification of Conditions for Protection by Automatic Disconnection of Supply

**WARNING**
The user is responsible to take protective measures against shock by indirect contact, while performing the tests.


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The conditions for automatic shutdown of the supply is set at *Mold-Masters* and is usually set such that the protective conductor resistance between the grounding conductor connection and all of the protective earth conductor connected parts, is Maximum 0.3 Ω.

In TN systems the following two checks must be made:

**Test 1 - Verifies the continuity of the protective bonding circuit**

The purpose of this test is to check whether all relevant touchable conductive parts are properly grounded. See the relevant requirements of the standard DIN EN 60204-1/ NFPA79.

The protective conductor resistance is measured with a special instrument with a current between at least 0.2 A and approximately 10 A derived from an electrically separated supply source (for example SELV, see 413.1 of IEC 60364-4-41) having a maximum no-load voltage of 24 V AC or DC.

The resistance should be within the expected range.

**Test 2 - Fault loop impedance verification and suitability of the associated overcurrent protective device**

The power supply connections and incoming external grounding connections to the hot runner system (usually through a temperature control device), must be verified by inspection.

The conditions for protection by automatic disconnection of supply must be checked by both:

(1) Checking the impedance of the fault loop by calculaton or measurement.

(2) Confirming that the setting and characteristics of the associated overcurrent protective device are in accordance with the requirements of the standard.

For more information, see the text of the EN 60204-1/ NFPA79 standards.

## Thermocouple Continuity Test

1. Measure the resistance between each pair of thermocouple wires on the mold's thermocouple connector. (See Figure 6-1). The resistance should be between 2.5 Ω and 25 Ω.

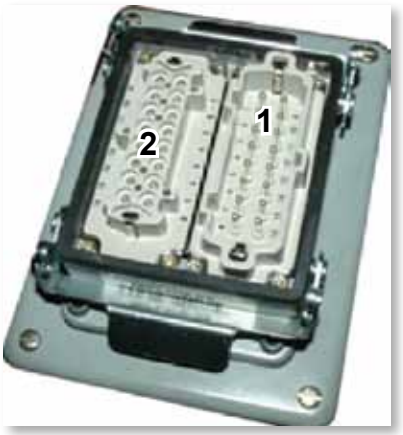


*Figure 6-1 Mold Plug*
*1. Mold Power Connector*
*2. Thermocouple Connector*

2. To verify alignment of thermocouple in the heating element, turn on one zone after the other and check that the temperature responds accordingly if the set temperature is adjusted.

## Pinch Point Test

1. If there is a suspected pinch point on the thermocouple, remove the thermocouple from the hot runner.
2. Connect a temperature control device to read the temperature.
3. Immerse the sheath of the thermocouple in boiling water to the point where the thermocouple reads the temperature.
4. A good thermocouple will show a temperature rise as soon as the tip of the thermocouple is immersed in water. If there is a pinch point in the thermocouple there will be no change in the reading until the pinch point on the thermocouple is immersed in water.

## Heating Element Check

Measure the resistance between each pair of heater power wires at the mold power connector.

Compare your reading with your general assembly drawing. $R = \frac{U^2}{P}$

Where:

R = resistance U = voltage P = power


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## Thermocouple Wiring Guidelines

- Thermocouples are Type "J" ungrounded and color coded to ASA standards. (White “+”/Red “- “).
- The tip must not be truncated or squeezed and must touch the bottom of the bore in order to measure the correct temperature.
- Each heat source should have its own closed loop temperature control in order to achieve accurate control.
- If there are not enough control zones, heat sources that have the same wattage and affect the same environment, may be grouped together.

**CAUTION**
Exceeding controller zone amperage will cause controller fuses to blow.

## Functional Test with a Temperature Controller

The functions of the electrical equipment must be checked. This test is carried out with an appropriate temperature control device.

- Monitor the initial heating of the system to minimize risk.
- Never start the heating with more than 40% of power.
- Stay a minimum of 5 minutes at 212°F (100°C) before increasing heat.

## Re-testing

Where a portion of the electrical equipment is changed or modified, that portion must be re-verified and re-tested, as appropriate.

# Section 7 - Hot Half Assembly

## Introduction

The following section is a step-by-step guide to assembling your *Mold-Masters* hot runner system.

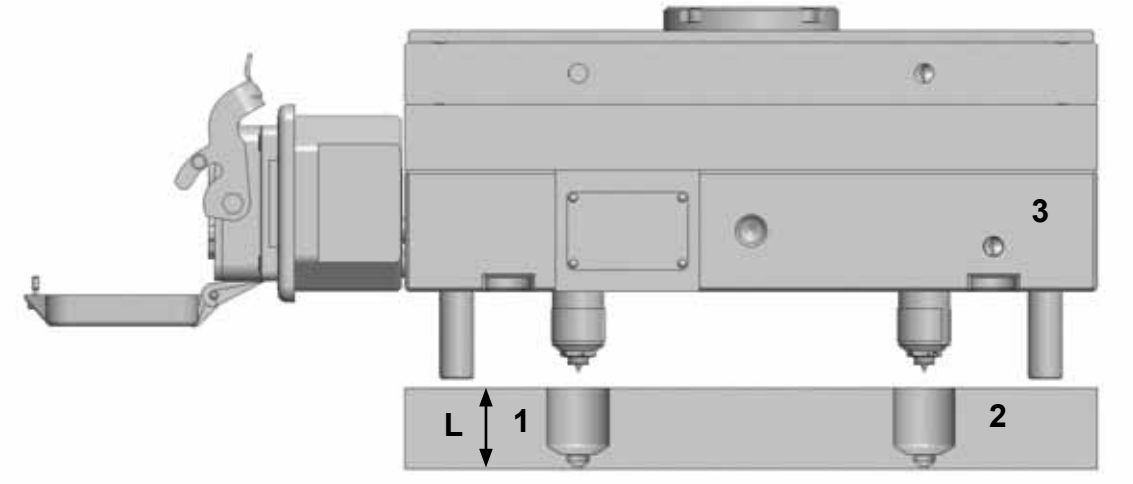


*Figure 7-1 Nozzle Depth; 1. Nozzle Well Depth (L) 2. Cavity Plate 3. Manifold Plate*

## Assembling the Hot Half

1. Check that the nozzle well depth (L) in the cavity plate is to *Mold-Masters* specifications. See Figure 7-1.

**NOTE**
For valved systems, the hot half is provided with valve pins already installed. Refer to the general assembly drawings for instructions. For valve assembly details refer to the Valve Actuator Section.

**WARNING**
Make sure the lifting eyebolt, lifting chain and crane are rated to adequately support the weight of the plate(s). Failure to do so can cause a serious injury. Do not assemble/disassemble cavity plate with the valve pins forward. Valve pins must be retracted prior to cavity plate installation.

**CAUTION**
Potential pinch point. Ensure that all wires are in the retainer grooves. Failure to do so can cause lost production due to hot runner down time. For valve gated systems it is recommended to have the pins in the open position to reduce the possibility of damage.

2. Attach a crane that is rated to adequately support the weight of the cavity plate.
3. Check that all wires are in the retainer groves.
4. Protect the gate seal before installing the cavity plate to the manifold plate.
   4.1 Leave the hot half in a horizontal position.
   4.2 Prepare the cavity plate for assembly.

**CAUTION - IMPORTANT!**
Heat up all manifolds to 356°F (180°C). This expands the system slightly to eliminate the cold clearance and ensures the nozzle stays straight ahead for correct alignment to the gate insert. Do not lose too much time before continuing to install the cavity plate. Damage may occur if the nozzle temperature becomes more than 100°F (55°C) hotter than the cavity plate.

5. Install the cavity plate to the manifold plate. If the plates are not assembling easily, remove the cavity plate and check for interference.
6. Install the mounting screws and torque to required specifications.

7. Attach a crane that is rated to adequately support the weight of the mold (cold half).
8. Latch the hot half to the cold half.

**WARNING**
Make sure the machine has been locked out and tagged out in accordance to the machines documented procedures. Failure to do so may lead to serious injury or death.

9. Refer to machine manufacturers documentation for procedures.
10. Install the mold into the molding machine.
11. Torque the mold mounting screws to required specifications.
12. Connect wire lines, hydraulic, pneumatic and electrical components.
13. Remove latches.

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# Section 8 - System Start Up & Shut Down

## Introduction

This chapter explains how to start up and shut down your hot runner system.

**NOTE**
See *Section 15 - Melt-Disk System* and *Section 16 - Melt-Cube System* for start up and shut down procedures for those products.

## Pre-Start up

1. Install the mold into the molding machine.

**NOTE**
The machine nozzle bore should be no smaller than 1.0mm (0.040”) smaller than the back plate bore and no larger than the back plate bore.

1. Connect all water lines and test to ensure there are no leaks and that the required flow is achieved in all water circuits.
2. Connect all hydraulic / pneumatic lines (if applicable).

**NOTE**
After the hot runner system is installed in the molding machine make sure to bleed all the air out of the hydraulic lines, if applicable. Failure to do so could result in high gate vestige.

**CAUTION**
Check that the system is heated to processing temperature before actuating the valve pins.
Failure to do so could cause damage to the valve pins.

3. Connect all electrical components and monitor to ensure that all zones are receiving heat and all thermocouples are reacting appropriately.
4. If applicable, test the valve pin actuation, but only if the hot runner is at processing temperature (see Caution above).

## Start up

**WARNING**
Take appropriate safety precautions by assuming the system is pressurized and hot at all times. Failure to do so could result in a serious injury or death.

**NOTE**
When running thermally *sensitive* materials, use a thermally *stable* material as recommended by the material supplier for the initial start up.

1. Turn on the machine barrel and mold cooling system.
2. Prior to start up, ensure the:
   - Machine barrel is up to processing temperature.
   - Mold cooling is on and at cooling temperature.
3. Heat up the hot runner system to processing temperature. Wait until ALL heating zones have reached processing temperature for 5 minutes before continuing.

**WARNING**
When the mold is open never inject material through hot runner system under high pressure. Failure to do so can result in serious injury or death.

4. Start up for empty systems or where there is no material in the gate detail. Extrude material through the hot runner system using 500 PSI (34.4 bar) of back pressure. The purpose is to fill the Visco-Seal at low pressure. This prevents any possibility of leakage past the nozzle seal.
4. Start up (for systems filled with material) - Purge intended shot size twice from the barrel prior to bringing the machine barrel forward to the hot runner interface.

5. Set injection time and pressure in coordination to part size, gate size and material.

**NOTE**
For hot runner systems using heater plates, allow 10 minutes of soak time after the system reaches processing temperature.

**CAUTION**
Failure to follow the above procedure may result in leakage/damage occurring in the hot runner.

## Shut Down

**NOTE**
For Melt-Disk, refer to the accompanying *Mold-Masters* Controller operating manual.

1. Turn off all heat to the system.
2. Leave the mold cooling system on, until the hot runner system temperature is within 100°F (55°C) of the mold temperature.

**NOTE**
Thermally sensitive materials should be purged from the hot runner system prior to shut down using a thermally stable material with a similar processing temperature. For example, a system running PVC should be initially started and subsequently shut down on LDPE.

# Section 9 - Color Change

Although it is not possible to make a generic color change procedure that will give the best performance in all circumstances (because the flow characteristics of the plastic polymers in use can influence color changes) there are specific procedures which work to enhance color changes.

## General Tips

- Always process a natural / clear color for the first shot on an empty hot runner system to coat the melt channel walls and gate bubbles with a neutral color.
- Ensure the hopper and conveying system are free of all contamination from the previous production color. Many times the previous color will hang up in the hopper or conveying system and be slowly released into the mold resulting in contaminated parts. Also, make sure there is no contamination in the resin being used in production.
- Schedule color changes from light to progressively darker.
- Understand the economics of your color change to decide if it is economically better to take the time to latch over the cavity plate and clean out the gate bubbles or just run scrap parts slightly longer to clean out the gate bubble area.
- Use purge compounds for color change in the machine barrel and hot runner.

### WARNINGS

To avoid serious burns when purging, wear safety clothing consisting of a protective heat-resistant coat, heat-resistant gloves and a full face shield over safety glasses.

Use adequate ventilation for fumes. Some plastics develop gases that may be dangerous to personal health. Follow the plastics supplier's recommendations.

Do not look directly into the feed throat of a hopper - use a mirror. Unexpected release of resin may cause serious burns.

Never handle plastic purgings or drool until they have completely cooled. Purgings may appear solid but may still be hot and cause serious injury.

## Procedure A: Simple & Effective

1. Empty hopper of existing color and clean thoroughly.
2. Increase hot runner system temperature on all zones 30-40°F (20°C) above processing temperatures. On *Mold-Masters* controllers, simply push the boost button on the controller to increase temperatures for a pre-determined time and temperature.
3. Back off the machine barrel, introduce the appropriate purge compound and purge until previous material is cleaned, then introduce new color. Increase barrel / extruder heats to help flush previous color (see machine maker recommendations).
4. Increase injection speed to help flush previous material.
5. Use hot runner purging compound (e.g. ASACLEAN™, Dyna-Purge®) at recommended temperatures to further reduce color change time.
6. Run parts until color has completely flushed through.
7. Continue processing while resetting hot runner system temperatures and injection speed back to normal.
8. Return all settings to normal and confirm acceptable part quality.

## Procedure B: More Comprehensive

1. Empty hopper of existing color and clean thoroughly.
2. Increase hot runner system temperature on all zones 30-40°F (20°C) above processing temperatures. On *Mold-Masters* controllers, simply push the boost button to increase temperatures for a pre-determined time and temperature.
3. Back off the machine barrel, introduce the appropriate purge compound and purge until previous material is cleaned, then introduce new color. Increase barrel / extruder heats to help flush previous color (see machine maker recommendations).
4. Increase injection speed to help flush previous material.
5. Use hot runner purging compound (e.g. ASACLEAN™, Dyna-Purge®) at recommended temperatures to further reduce color change time.
6. Run 10 - 15 shots with natural material.
7. Back off the injection unit and switch off all heat on the hot runner.
8. Allow the hot runner system to cool down.
9. Latch over cavity plate.
10. Remove and clean gate bubbles.
11. Latch back cavity plate.
12. Turn on the hot runner system and heat to processing temperature.
13. Bring machine barrel back in.
14. Fill the hot runner with natural color resin to coat the melt channels with a neutral color (1-2 shots)
15. Introduce the new color.
16. Leave mold in open position and set the shot size to maximum possible.
17. Purge the entire shot through the hot runner and out the gates into the exposed cavity at the highest injection rate possible. Repeat this several times. [Tip: It may be advisable to put a protective shield over the core side to prevent plastic from injecting and cooling on the core side].
18. Set the shot size back to normal levels and begin processing parts with increased injection speeds and mold temperature.
19. Continue processing while resetting hot runner system temperatures and injection speed back to normal.
20. Return all settings to normal and confirm acceptable part quality.

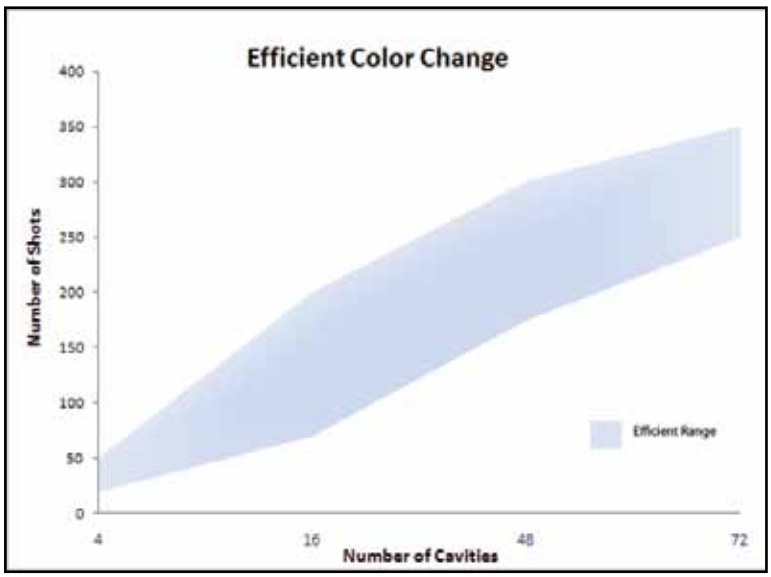



*Figure 9-1 Efficient Color Change Range*

# Section 10 - Hydraulic / Pneumatic Actuators

## Introduction

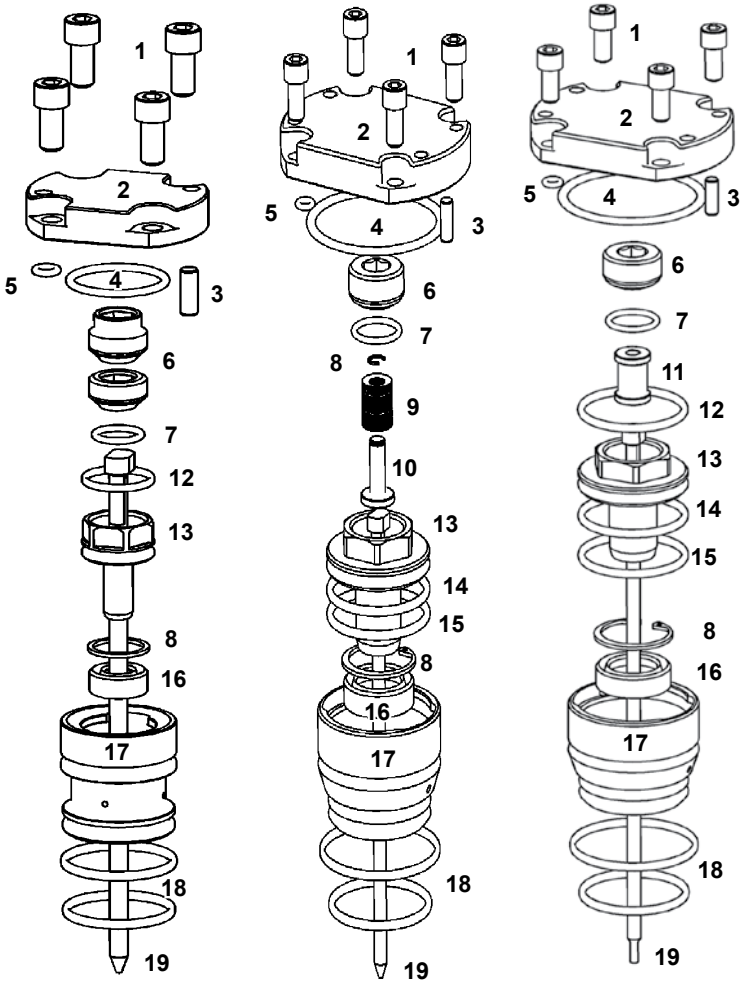
This section explains how to assemble and install the valve actuator for:

- 5500 Series
- 6500, 6600, and 6700 Series
- 7100 Series

## Installation and Assembly of the Valve Actuator

The following procedure explains how to assemble and install the valve actuator on a bench.

**NOTE**
These procedures require certain parts to be lubricated or greased.




*5500 Series* *6X00 Series* *7100 Series*

Valve Actuator Components

*1. Screw*
*2. Cylinder Top*
*3. Locating Dowel*
*4. Cylinder Top O-Rings*
*5. Small O-Ring*
*6. Piston Top*
*7. O-Ring*
*8. Circlip*
*9. HY6X00 Spring Assembly*
*10. HY6X00 Stud*
*11. HY7100 Spacer*
*12. Outer Seal*
*13. Piston*
*14. Inner Viton O-Ring*
*15. Outer Viton O-Ring*
*16. Rod Seal*
*17. Cylinder*
*18. Cylinder Bottom O-Rings*
*19. Valve Pin*

*Figure 10-1*

## Pre-Installation

1. Prior to installing the actuator unit, check that all fluid lines in the mold plate are de-burred and clean.
2. Use denatured alcohol to remove the rust inhibitor compound from each part. Do not clean the interior of the cylinder.

## Cylinder Bottom Assembly

1. Insert the rod seal support disk into the cylinder (6X00 and 7100 only).
2. Press the rod seal into position.
3. Install the circlip with sharp edges facing up.
4. Lubricate the bottom cylinder external O-rings and install.

*Figure 10-2 6X00 and 7100 Bottom Cylinder*
*1. Circlip 2. Rod Seal*

*Figure 10-3 6X00 and 7100 Bottom Cylinder O-Rings*

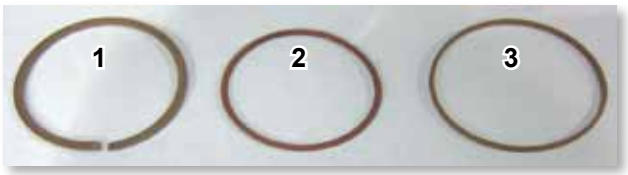



*Figure 10-4 Seal Kit PS0003*
*1. Back Up Ring 2. Inner Viton O-Ring 3. Outer Seal*

## Piston Assembly

### 5500 Only

1. Lightly use silicone grease and install the O-ring on the piston.

### 6X00 and 7100 Series

1. Using silicone grease, lightly grease and install the inner Viton O-ring on the piston.
2. Install the back-up ring.
3. Install the outer seal. The seal should sit on top of the inner Viton O-ring. An installation tool is available (PS0003TOOL02) for installing the seal.
4. Once all 3 rings have been assembled, place installation tool PS0003TOOL01 over assembly as shown and allow rings to settle.

*Figure 10-5 Piston Assembly*
*1. Back Up Ring*
*2. Inner Viton O-Ring*

*Figure 10-6 Outer Seal Assembly*
*3. Outer Seal 4. Installation Tool PS0003TOOL02*

*Figure 10-7 Piston Assembly*
*1. Piston Bottom*
*2. Installation Tool PS0003TOOL01*

## Cylinder Top Assembly

On the inside face of the cylinder top:

1. Insert the locating dowel.
2. Using silicone grease, lightly grease and insert the small O-ring.
3. Using silicone grease, lightly grease and insert the large O-ring.

*Figure 10-8 Typical Cylinder Top*
*1. Large O-Ring 2. Small O-Ring*
*3. Cylinder Top 4. Locating Dowel*

## Valve Pin Finishing of Tip

### 5500 Series

1. Install the cylinder (where applicable) and piston bottom, (without the pin and piston top) into the hydraulic plate.
2. Measure the distance AD and AC.

**NOTE**
Heat expansion difference to be removed from pin head.

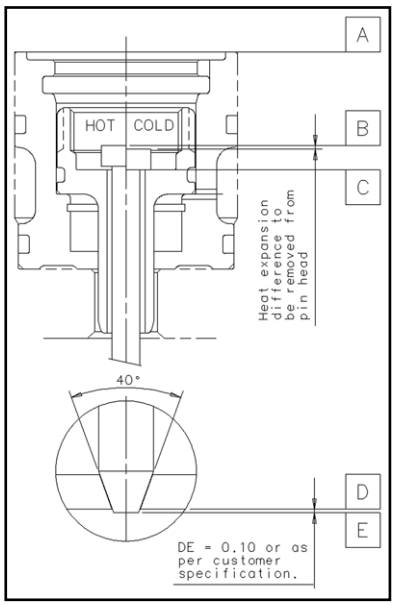



*Figure 10-9 Measure Distance*

3. Cut pin to calculated length "L". (L = AD - AC + DE + 3.05*+0.02**)
   L = overall length from tip to top of pin head
   * 3.05 = head of pin
   ** 0.02 = pressure preload
4. Grind the valve pin tip an angle of 20° per side (40° inclusive).
5. Lap the tip of the pin into the land area (steel section in the gate area) using a lapping guide bushing or valve bushing as a lapping guide. We recommend 400 - 600 grit lapping paste.

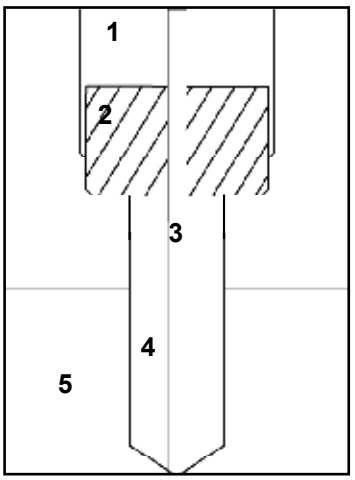



*Figure 10-10a*
*1. Nozzle Flange Bore 2. Machined Bushing for Center Alignment*
*3. Tapered/Angled Valve Pin*
*4. Nozzle Well Bore 5. Cavity*

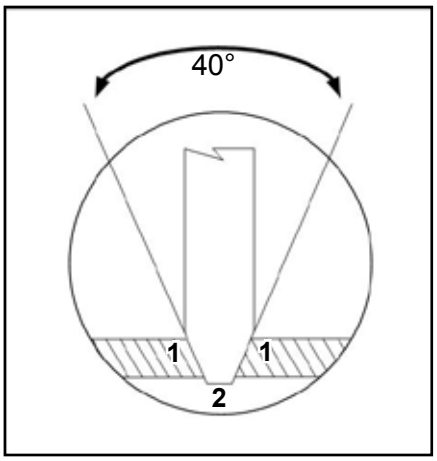



*Figure 10-10b Land Location*
*1. Land Area 2. Cavity Face*

### 6X00 Series

1. Calculate the heat expansion factor.
   Fh = (Processing temperature - Mold temperature) °C x 0.000012.
2. Calculate the heat expansion of the valve pin.
   HE = distance BC x heat expansion factor = BC x Fh.
3. Cut pin to calculated length “L”. (L = AC - 36.35 - HE + 0.3 + CD).
4. Grind the valve pin tip to an angle of 20° per side (40° inclusive). Refer to Figure 10-10.
5. Lap the tip of the pin into the land area (steel section in the gate area) using a lapping guide bushing or valve bushing as a lapping guide. We recommend 400 - 600 grit lapping paste.

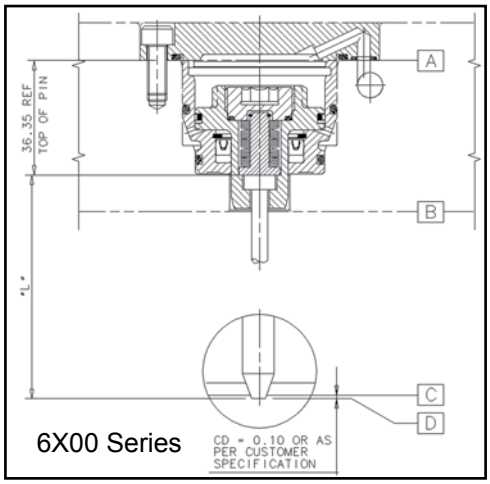



*Figure 10-11 Measure Distance*

### 7100 Series

1. Install the cylinder (where applicable) and piston bottom, (without the pin and piston top) into the hydraulic plate.
2. Measure the distance AC and BC.

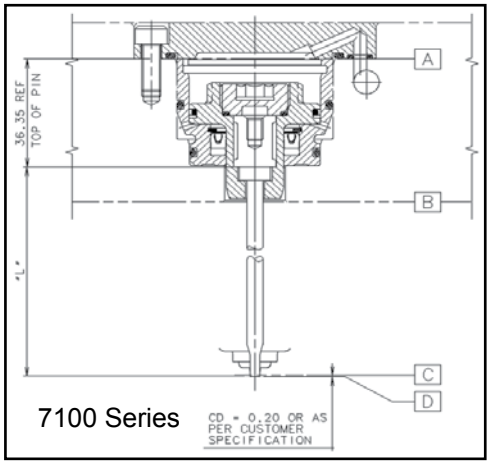



*Figure 10-12 Measure Distance*

3. Calculate the heat expansion factor.
   Fh = (Processing temperature - Mold temperature) °C x 0.000012.
4. Calculate the heat expansion of the valve pin.
   HE = distance BC x heat expansion factor = BC x Fh.
5. Cut pin to calculated length “L”. (L = AC - 36.35 - HE + CD).
6. Grind the valve pin tip to fit the cylindrical gate. (Refer to the system gate detail.)
7. Assemble the hydraulic unit.
8. Heat the hot runner system to processing temperature.
9. Soak the pin in the hot runner system for 10 minutes to achieve the maximum heat expansion of the pin at the processing temperature. (Mold cooling should be running).
10. Measure the distance CD in the heated condition. Check that the head of the pin is seated.
11. Calculate the dimension to be ground (L2). L2 = CD (measurement) - CD (specified).
12. Grind the pin end to remove L2 (finish cut).

**NOTE**
When the gate vestige is critical, it is recommended to mold sample parts and measure samples to adjust the final pin length.

Steel quality in the gating area must have:

- High grade of toughness (H13, 1.2344)
- Hardness of HRc, 46-48
- No nitration
- No chrome plating

The bottom of the nozzle well in the gate area must be free of stress caused by:

- Rough EDM
- Rough machining
- Sharp corners (JIG grinding is recommended)

# Valve Pin Lapping Procedure for Tapered Valve Pins

### 5500 and 6X00 Series

If the shut off between the valve pin and gate area is not satisfactory, lapping of the valve pin into the gate will be required. A support bushing that fits into the nozzle flange area should be manufactured with the pin diameter in the center of the support bushing to properly align the pin with the gate area (see below). Or use the nozzle well diameter of the cavity for the support bushing as a lapping guide.

1. Install the machined bushing with the center hole matching the pin diameter.
2. Insert the valve pin through the bushing.
3. Add 400 grit lapping paste to the tapered area of the pin and lapp into the gate. Verify the shut-off with bluing compound.
4. Be sure to remove all lapping paste from the valve pin and cavity, before continuing with actuator assembly.

**NOTE**
Do not permit the lapping paste to enter the valve bushing bore.

**WARNING**
Avoid skin contact with decomposing O-rings. Use appropriate protective clothing. Failure to do so can cause serious injury.

**NOTE**
The Viton O-rings used for the valve actuators are rated for operation below 200°C (400°F).
Always turn ON the plate cooling prior to heating the hot runner system. Refer to the warning if O-rings have been subjected to higher than rated temperatures.

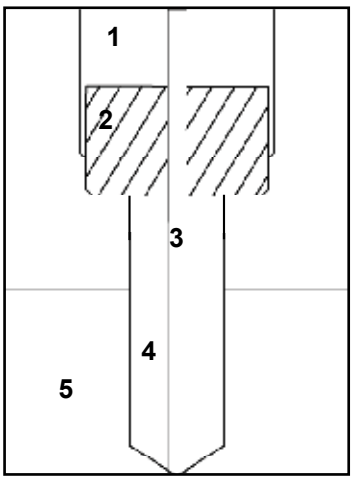



*Figure 10-13 Bushing for Pin Lapping*
*1. Nozzle Flange Bore 2. Machined Bushing for Center Alignment 3. Tapered/Angled Valve Pin 4. Nozzle Well Bore 5. Cavity*

# Valve Pin Finishing of Head

### 5500 Series

1. Heat the hot runner system to the processing temperature.
2. Allow the pin to soak in the hot runner system for 10 minutes to achieve the maximum heat expansion of the pin at processing temperature. (Mold cooling must be running).

**WARNING**
Extreme heat. Avoid contact with heated surfaces.
Use appropriate protective clothing. Failure to do so can cause serious injury.

3. Measure the distance AB in heated condition.

**NOTE**
Heat expansion difference to be removed from pin head.

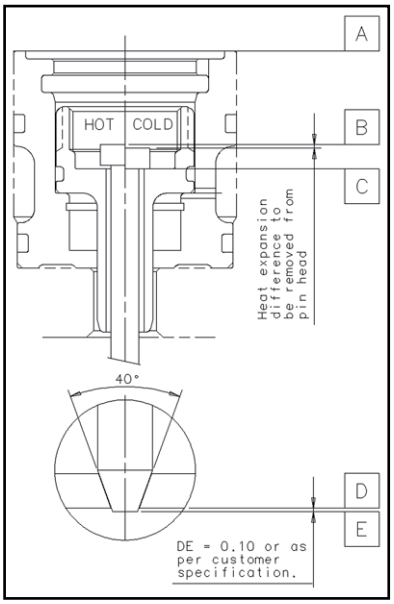



*Figure 10-14 Measure Distance*

4. Check that the tip of the pin is fitted correctly into the land.
5. The heat expansion difference between the mold and hot runner is removed by grinding the back of the pinhead.
6. HED = AC - (AB + 3.05* + 0.02** preload)
   HED = heat expansion difference
   * 3.05 = head of pin
   ** 0.02 = pressure preload
7. Continue to re-assemble the actuator assembly. The maximum pin preload in the land under full heat expansion must not exceed 0.02mm.

**NOTE**
The standard stroke of the HY550* A/E is 4.0mm. This can be increased to maximum of 8.0mm by removing material from the piston top.
The stroke of the HY550* C/F is 8.0mm and cannot be altered.

## Valve Pin Assembly

**CAUTION**
**For systems with MEX, Accu-Valve EX or Accu-Valve CX Gate Seals:**

Gate seals must be removed prior to installing valve pins.

### 5500 Series

1. Check the valve pin length. Refer to:
   "*Valve Pin Finishing of Tip*",
   "*Valve Pin Finishing of Head*".
2. Slide the valve pin into the piston.
3. Grease and install the O-ring.
4. Install the piston top and tighten, torque setting 15-20 ft -lbs (20-27 Nm).

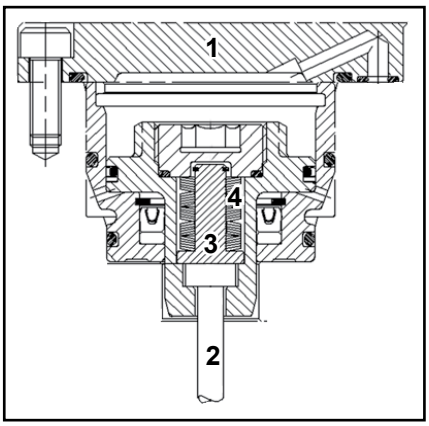



*Figure 10-15 8 X 5 Disk Spring Assembly; 1. Cylinder Top 2. Valve Pin 3. Spring Retainer Stud 4. Disk Springs*

### 6X00 Series

1. Check the valve pin length. Refer to "*Valve Pin Finishing of Tip*".
2. Slide the valve pin into position.

   **CAUTION**
   Failure to install the disk springs in the correct order will cause damage to the gate.
3. Assemble the disk springs to the spring retainer stud.
   a. Check for the correct orientation of the disk springs when installing.
   b. HY6500 series: Align the springs in 5 alternating groups of 5, convex and concave.
   c. HY6600 and 6700 series: Align the springs in 8 alternating groups of 6, convex and concave.
4. Install the disk spring assembly on top of the valve pin.
5. Grease and install the O-ring.
6. Install piston top and tighten, recommended torque setting 15-20 ft- lbs (20-27 Nm).

*Figure 10-16 Piston Spacer Installation*
*1. Actuator Spacer 2. O-Ring 3. Spacer Threads Up*
*4. Piston 5. Piston Top*

### 7100 Series

1. Check the valve pin length.
2. Slide the valve pin into the piston.
3. Install the actuator spacer with the threaded side facing towards the piston top.

**NOTE**
The threaded side is used for removal or installation use. By installing a screw into the spacer's threaded end it allows for simple extraction of the spacer.

4. Grease and install the O-ring.
5. Install piston top and tighten, recommended torque setting 15-20 ft-lbs. (20-27 Nm).

*Figure 10-17 Cylinder Installation*

## Installing the Valve Actuator to the Hydraulic Plate

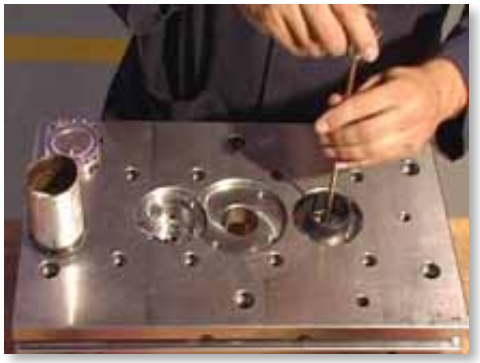


*Figure 10-18 Valve Pin and Piston Installation*
*1. Valve Pin and Piston 2. Installation Tool*

The following procedure is for new systems.

1. Lubricate the sides of the actuator cylinder, before installing into the hydraulic plate.

**CAUTION**
Check for sharp edges before installing the cylinder. Failure to do so could damage O-rings.

2. Tap the cylinder into the bore of the actuator plate with a nylon mallet.
3. Position the piston installation tool (PS0003TOOL01) on top of the cylinder.
4. Install the valve pin and piston into the cylinder bottom.

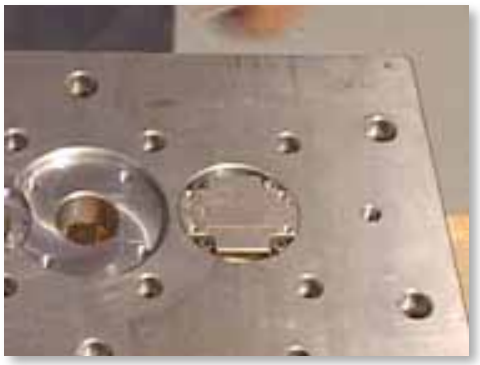


*Figure 10-19 Cylinder Top*
*1. Cylinder Top 2. Mounting Screws*
*3. Hydraulic Plate*

5. Press the valve pin into position, using a nylon mallet to finish seating the valve pin into the assembly.

**CAUTION**
Heat sensitive materials should be purged with a compatible less sensitive material. If the system is not purged material in the manifold could degrade resulting in poor quality of product.

6. Remove the installation tool.
7. Check that the cylinder top dowel and O-rings are installed.
8. Install the cylinder top.


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*Figure 10-20 HY5500 Series Cylinder Extraction Tool Kit*

*Figure 10-21 HY6/7*00 Series Cylinder Extraction Tool Kit*

## Maintenance Procedure

### HY5500, HY6X00 and HY7100 Series

**CAUTION**

Heat sensitive materials should be purged from the system prior to maintenance. Failure to do so may result in degradation of material in the system.

When heating the hot runner system for maintenance, mold cooling should be on to protect seals and o-rings.

**CAUTION**

**For systems with MEX, Accu-Valve EX or Accu-Valve CX Gate Seals:**

Gate seals must be removed prior to removing or re-installing valve pins.

If material is present in the mold, raise nozzle temperature enough to allow removal or installation of the valve pin. However, nozzle temperature should not be high enough to allow excessive material flow from the nozzle into the thread area.

After installing valve pins thoroughly clean the nozzle seat and thread area.

Actuator units should be inspected every 12 months or per pre-determined maintenance schedule.
The following procedures are performed on a bench.

**For Oil Systems:**

1. Remove oil from system.
2. Remove the cylinder top with tool in upright position to prevent oil from entering the system.
3. Heat up the system (required to remove the valve pin).

**For Pneumatic Systems:**

1. Remove the cylinder top for every zone.
2. Heat up the system (required to remove the valve pin).

**WARNING**

Extreme Heat. Avoid contact with heated surfaces.

Use appropriate protective clothing. Failure to do so can cause serious injury. If possible keep cooling on within hot half.

Do not assemble new O-rings if the plates are still hot.
Drain the oil before removing the pin from the hydraulics.

3. Install the cylinder extraction tool to assist with the removal of the cylinder.
4. Disassemble the system.
5. Inspect components.
6. Replace O-rings. O-ring replacement kit is OR550P1 for 5500 series and OR650P2 for 6X00 and 7100 series.
7. When installing the rod seal, check that the rod seal is seated to the base of the cylinder and is secured in place with the circlip.
8. To complete the assembly, refer to:
   a. Cylinder Bottom Assembly
   b. Piston Assembly
   c. Cylinder Top Assembly
   d. Figure Valve Pin Assembly
   e. Installing the Valve Actuator to the Hydraulic Plate.

# Extraction Tools for Hydraulic Units & Pistons

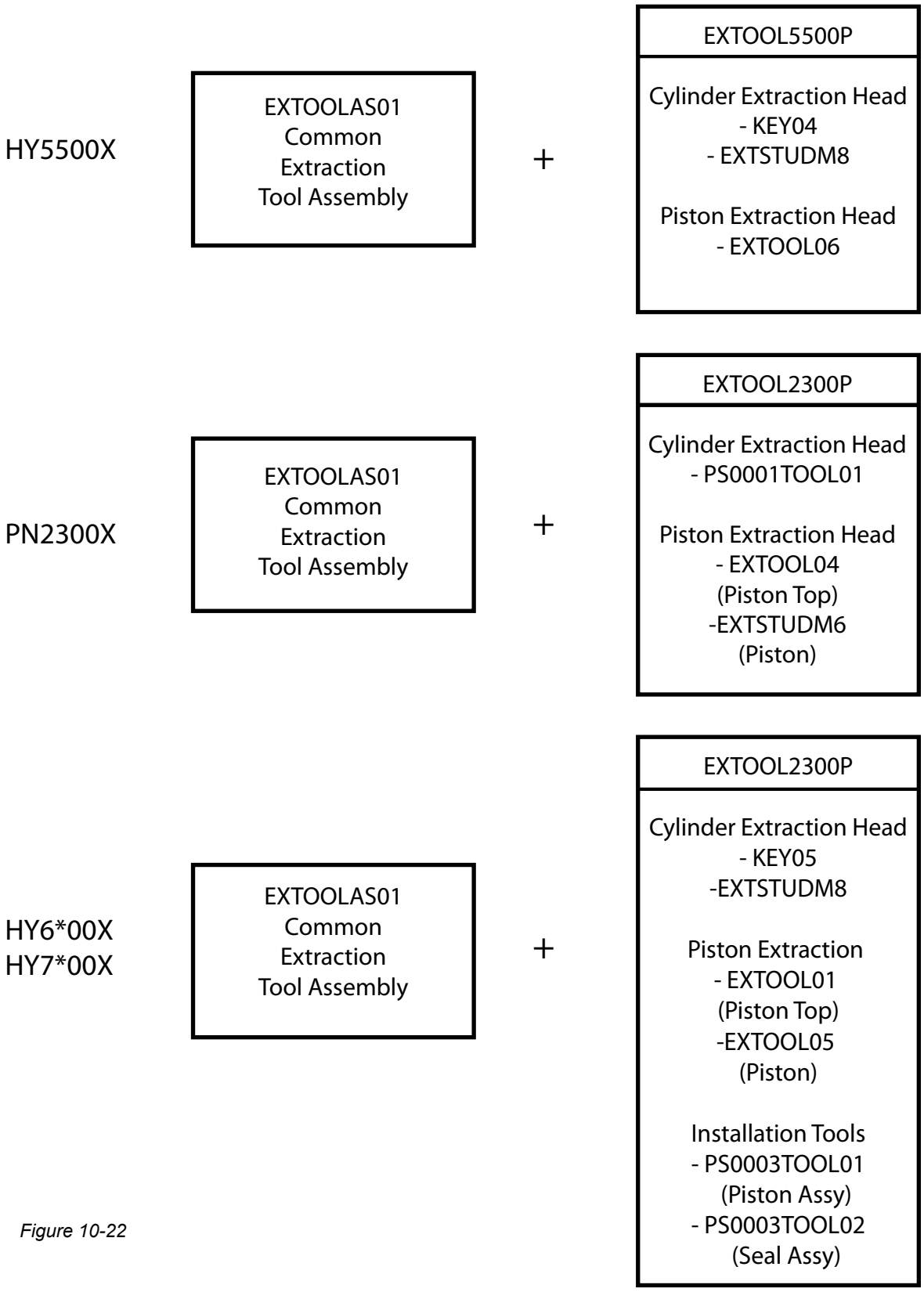


*Figure 10-22*

# Section 11 - Electric Actuators

## Electric Valve Actuator Selection Chart

| Part Name | Part Description |
|---|---|
| ES5510003A | Solenoid size 55mm stroke 3mm |
| LS0001A | ES5510003A DOUBLE ACTING LINEAR SOLENOID PACKAGE w/VP-HOLDER14 & 3.0mm PIN (10" LG.) 3mm STROKE (48VDC) |
| LS0001B | ES5510003A DOUBLE ACTING LINEAR SOLENOID PACKAGE w/VP-HOLDER14 & 3.0mm PIN (14" LG.) 3mm STROKE (48VDC) |
| LS0001x | ES5510003A DOUBLE ACTING LINEAR SOLENOID PACKAGE w/VP-HOLDER14 w/o 3.0mm PIN 3mm STROKE (48VDC) |
| ES7510003A | Solenoid size 75mm stroke 3mm |
| LS0002A | ES7510003A DOUBLE ACTING LINEAR SOLENOID PACKAGE w/VP-HOLDER13 & 3.0mm PIN (10" LG.) 3mm STROKE (48VDC) |
| LS0002B | ES7510003A DOUBLE ACTING LINEAR SOLENOID PACKAGE w/VP-HOLDER13 & 3.0mm PIN (14" LG.) 3mm STROKE (48VDC) |
| LS0002x | ES7510003A DOUBLE ACTING LINEAR SOLENOID PACKAGE w/VP-HOLDER13 w/o 3.0mm PIN 3mm STROKE (48VDC) |
| ES7510008A | Solenoid size 75mm stroke 8mm |
| LS0003A | ES7510008A DOUBLE ACTING LINEAR SOLENOID PACKAGE w/VP-HOLDER13 & 3.0mm PIN (10" LG.) 8mm STROKE (48VDC) |
| LS0003B | ES7510008A DOUBLE ACTING LINEAR SOLENOID PACKAGE w/VP-HOLDER13 & 3.0mm PIN (14" LG.) 8mm STROKE (48VDC) |
| LS0003x | ES7510008A DOUBLE ACTING LINEAR SOLENOID PACKAGE w/VP-HOLDER13 w/o 3.0mm PIN 8mm STROKE (48VDC) |


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# ES Solenoids

ES Solenoids are precision engineered actuators with integrated permanent magnets. Inside the actuator, a moving armature is guided by linear bearings. The armature can take two end positions and is solidly held at these positions by permanent magnets. Switching between both end positions is accomplished by energising the coils.

**CAUTION**
Switching between both end positions of the armature must only take place by means of applying an electric current to the coils. Any switching with external mechanical means may lead to the destruction of the ES solenoid.

## Safety Warnings

This product contains permanent magnets which generate a magnetic field even if the coil is not energised. This magnetic field is also effective outside of the product.

The following warnings indicate a potentially hazardous situation, which if not avoided, could result in serious injury or death.

- Magnetic fields can erase data stored on magnetic media. They can also influence or even destroy electronic and mechanic components, such as pacemakers. For this reason, the required safety distances need to be observed.
- Certain magnetic materials are toxic and/or easily soluble and therefore represent a safety hazard. Destruction and disintegration can be caused by corrosion, chemical influences, other magnetic fields, high temperatures etc. Direct contact with magnetic materials may result in allergic reactions.
- For shipping via airfreight, a dangerous goods declaration is required. Permanent magnets may not be exposed to radioactive emissions.
- During its operation, the ES solenoid may develop considerable heat. Physical contact with the solenoid during operation may result in burns.
- Loud noises can be caused during operation. Wearing hearing protection is strongly recommended.
- Activating the ES solenoid manually with external mechanical tools may lead to serious physical harm.
- When applying mechanical forces, please take into consideration that the material may break or splinter.
- Turn off a defective solenoid immediately and disconnect it from its power supply.
- The ES solenoid must be mechanically fixed before operating.
- The latest standards and regulations, such as the Low Voltage Directive need to be observed when installing the ES solenoid. In addition, any technical information printed on the label and the packaging must be observed.

## Cautions

Damage to the solenoid is possible if the following cautions are not followed.

- **Any switching with external mechanical means may lead to the destruction of the ES solenoid.**
- **Oiling or greasing the moving parts of the solenoid may lead to a total failure of the ES solenoid.**
- Applying an improper voltage to the coils or exceeding the nominal switch on period may damage or thermally destroy the solenoid by overheating.
- Any mechanical damage of the surfaces may lead to corrosion.
- Exposing the unit to hard shocks during installation may interfere with the function of the ES solenoid.
- All wire leads and electrical contacts need to be protected against mechanical damages.
- Exposure to high temperatures will irreparably damage the permanent magnets.
- Prevent magnetisable particles, such as iron cuttings from getting close to the product.

- Exposing the ES solenoid to dust particles will reduce the life cycle of the bearings guiding the armature.
- Modifications of the ES solenoid may limit its function or lead to its total failure.
- The ES solenoid should be installed at a clean location.
- Only use the mounting holes provided to attach the unit.
- Use screws to mechanically attach the ES solenoid and tighten them with an appropriate torque before connecting the unit electrically.
- To apply the supply voltage, only use leads with a sufficient cross section and insulation.
- Solvents, such as Acetone or Benzine can influence the function of the ES solenoid. You may safely remove metal cuttings stuck to the solenoid by means of an adhesive tape.
- Store in a dry location at the required storage temperature.

## Additional Tools Required

The following tools are required in addition to those listed in Section 4:

- Valve pin pulling tool.
- Long M5 hex key with T-handle and snap ring in tip (*Mold-Masters* item number: KEY-BPHEXTKEY5.0).
- Grease: Castrol Longtime PD2 (*Mold-Masters* item number: 104L1105I).
- Proper Valve Pin extraction tools.

## Specifications

Input power: 230 V

Actuator stack height: 100mm + 35mm mounting plate

Stroke length:

- for 55mm solenoid: 3mm
- for 75mm solenoid: 3mm and 8mm

Minimum pitch:

- for 55mm solenoid: >58mm
- for 75mm solenoid: >78mm

Available gating styles: any cylindrical valve gate

Number of cavities: 2-8

Resins: commodity resins, ABS, PA

Maximum valve pin diameter:

- for 55mm solenoid: 3.2mm
- for 75mm solenoid:
  - with 3mm stroke: 5.2mm
  - with 8mm stroke: 3.2mm

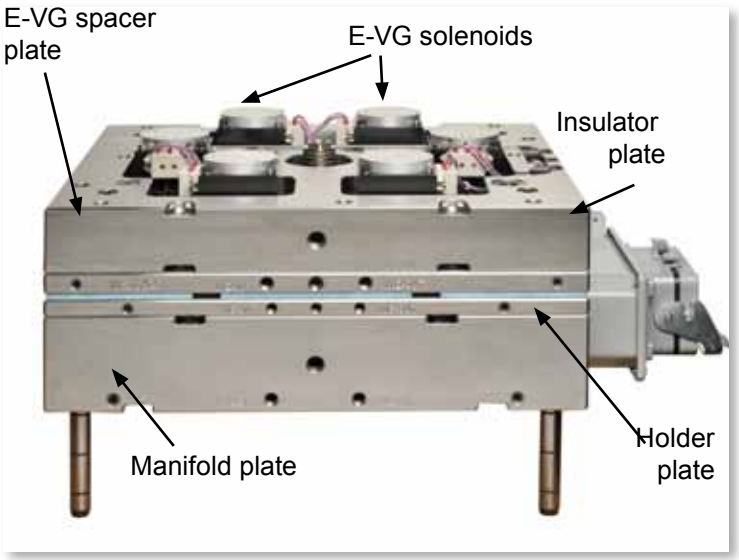



*Figure 11-1 Example: 6 Cavity hot half with E-VG units. Stack for high mold temperature >122°F (50°C)*

*Figure 11-2 Example: 2 Cavity Accu-Valve CX hot half and 75 mm and 55 mm EVG. Stack for low mold temperature <122°F (50°C)*

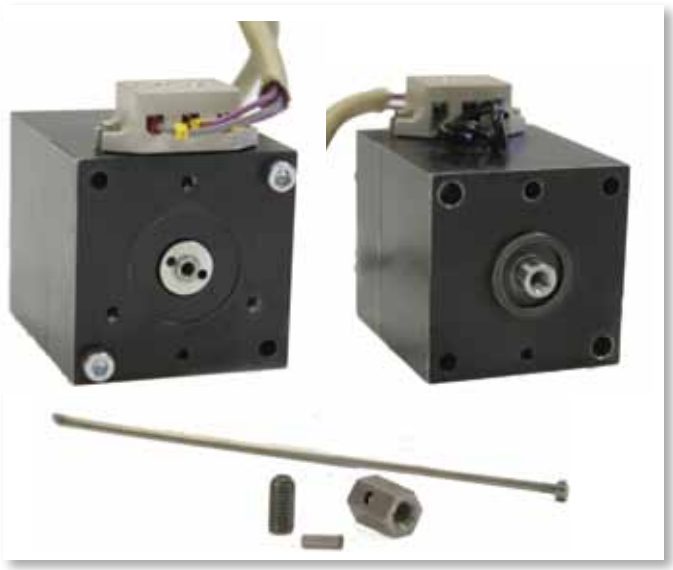


*Figure 11-3 75 mm E-VG with VP Holder14*

*Figure 11-4 55 mm E-VG with VPHolder13*

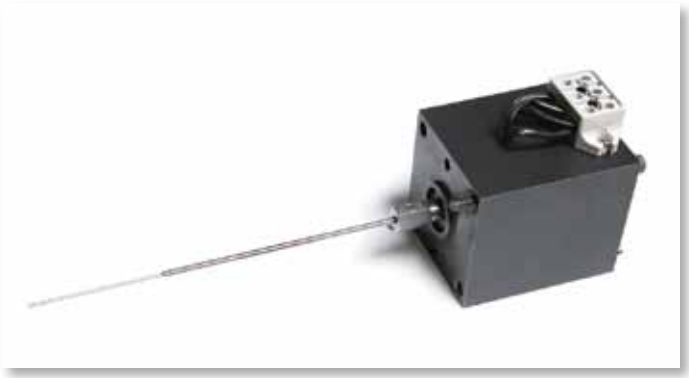


*Figure 11-5 E-VG with Valve Pin Assembled*

## Pin Height Adjustment

The following procedure is for adjusting the pin height. The pin height can be adjusted +/- 1 mm in each direction (forward or back).

**NOTE**
Pin height adjustments need to be done when the system is hot in order for the pin to be a true length in operating conditions. Failure to do so could result in damage to the gate.

**CAUTION**
Water circulating in the holder space plate should be 25°C or below.

1. Open the lock nut using the supplied lock nut tool.
2. Use the M5 hex key (KEY-BPHEXTKEY5) to turn the adjusting screw clockwise (to move the pin forward) or counter-clockwise (to move the pin back).
3. When the pin is in the correct position hold the screw with the hex key and tighten the lock nut.

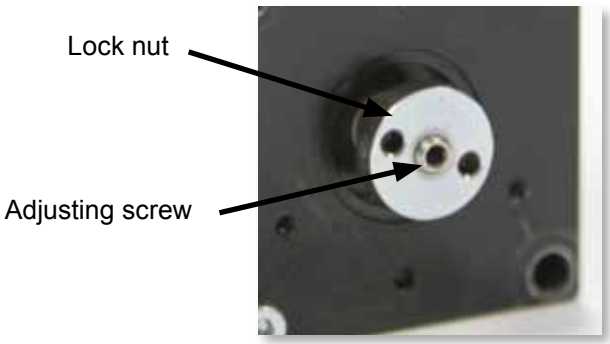



*Figure 11-6*

## Pin Removal from 75 mm E-VG (VPHolder13)

1. Remove the E-VG unit.
2. Loosen the hexagon pin holder.
3. Anchor the unit in a vice and use the M5 hex key (KEY-BPHEXTKEY5) to remove the set screw.
4. Pull the set screw out.
5. Remove the dowel pin.
6. Pull the pin out.

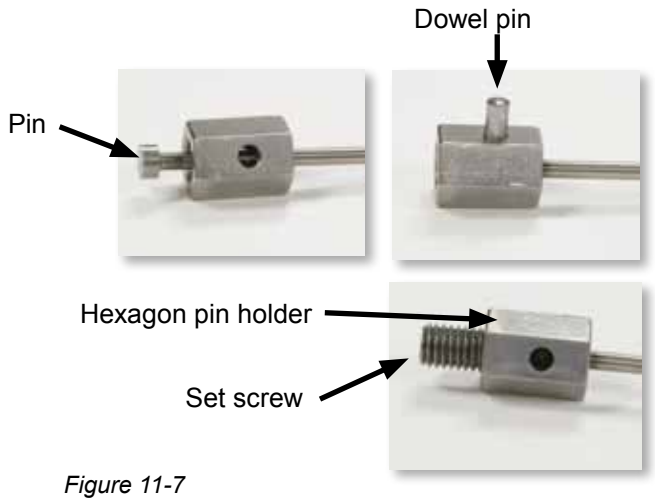



*Figure 11-7*

## Pin Installation into 75 mm E-VG (VPHolder13)

1. Place the pin in the pin holder.
2. Apply high strength thread locking compound to the dowel pin and insert it into the pin holder.
3. Apply high strength thread locking compound to the set screw and tighten set screw into the pin holder.
4. Screw the set screw back into the E-VG unit.

*Figure 11-8*

## Pin Removal 55 mm E-VG (VP-Holder14)

1. Remove the E-VG unit.
2. Unthread the hexagon valve pin holder from the EVG.
3. Use pliers to remove the holder clip.
4. Remove the pin.

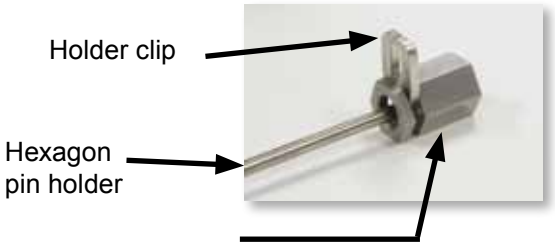



*Figure 11-9*

## Pin Installation 55 mm E-VG (VPHolder14)

1. Place the pin in the pin holder.
2. Install the clip to hold the pin in place.
3. Apply high strength thread locking compound to the pin holder and insert it into the E-VG unit.
4. Screw the valve pin holder onto the E-VG unit.

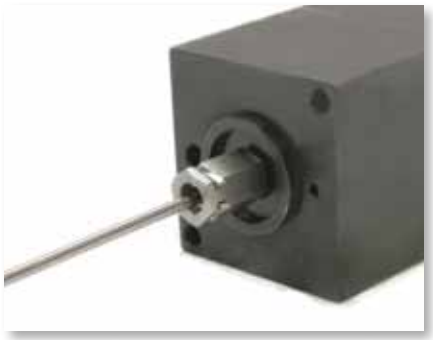


*Figure 11-10*

## Removing E-VG Unit from Hot Half

1. Unscrew and remove the wire harness cover plate.

*Figure 11-11*

2. Remove the wires from the wiring harness.

*Figure 11-12*

3. Loosen and remove the BLACK mounting screws.

**CAUTION**
DO NOT remove the SILVER screws.

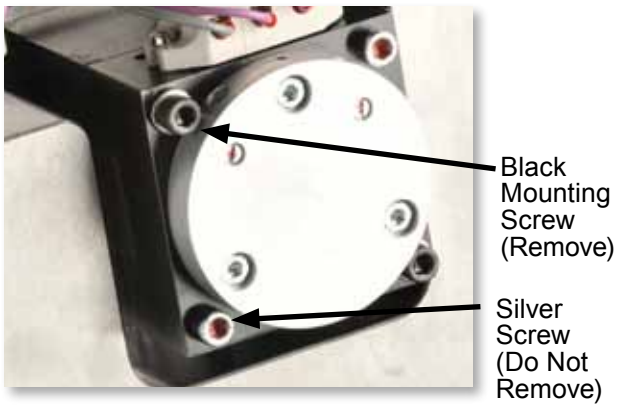



*Figure 11-13*

4. Carefully slide the E-VG unit valve pin out of the valve bushing.

*Figure 11-14*

# Installing E-VG Unit into Hot Half

1. Insert the valve pin into the valve bushing.

*Figure 11-15*

2. Insert the BLACK mounting screws.

*Figure 11-16*

3. Tighten the BLACK mounting screws to the torque setting indicated on the assembly drawing.

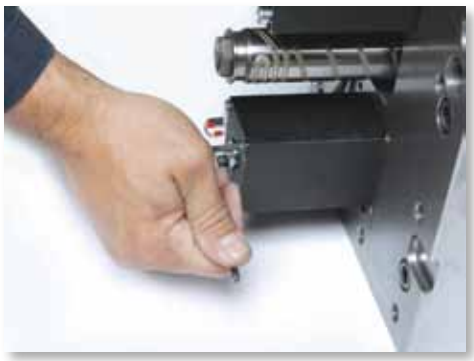


*Figure 11-17*

4. Complete wiring per assembly drawing.

*Figure 11-18*

5. Install wiring harness cover plate.

*Figure 11-19*

# Section 12 - Maintenance Procedures

## Introduction

This chapter is a guide to maintaining selective components. Repairs that should be performed by *Mold-Masters* personnel are not included. If you need an item repaired that is not included in this section, please call *Mold-Masters* support. The phone number and system identifier is located on the mold.

## Valve Disk Removal

Some valve disks may be difficult to remove. Use the following procedure to extract the valve disk from the manifold.

**CAUTION**

Check that the manifold is secure.

For “Cast in Systems” secure the manifold with clamps to prevent movement.

Never heat up the system without first clamping the main manifold, especially if the nozzles are not secured with the hot half. This prevents resin from leaking between the nozzle and hot half.

*Figure 12-1 Manifold Clamps*

**WARNING**

All maintenance on *Mold-Masters* products should be performed by properly trained personnel based on local law or regulation requirements. Electrical products may not be grounded when removed from the assembled or normal operating condition. Assure proper grounding of all electrical products before performing any maintenance to avoid potential risk of electrical shock.

To avoid serious burns wear safety clothing consisting of a protective heat resistant coat and heat-resistant gloves. Use adequate ventilation for fumes. Failure to do so can result in serious injury.

1. Heat the manifold to allow any plastic still in the system to become soft.
2. For 1-Pc Valve Disk:
   a) Attach the valve disk extraction tool to the valve disk.
   b) Attach the EXTOOLAS01 tool to the valve disk extraction tool.
   c) Extract the valve disk.

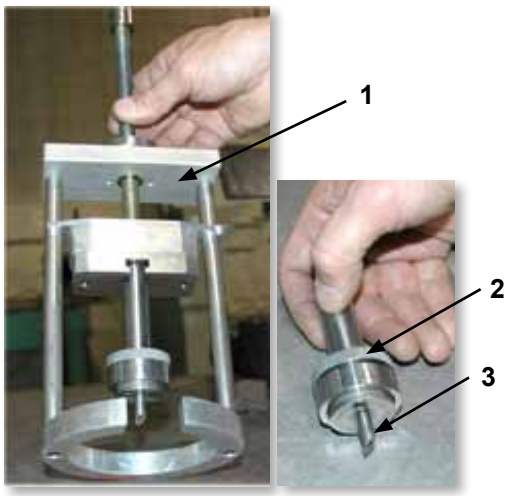



*Figure 12-2a 1-Pc Valve Disk Extraction*
*1. EXTOOLAS01 2. Valve Disk Extraction Tool*
*3. Valve Disk (1-pc)*

3. For 2-Pc Valve Disk:
   a) Remove the Valve Flange prior to installing extraction tool.
   b) Attach the extraction tool to the Valve Stem and remove the stem.

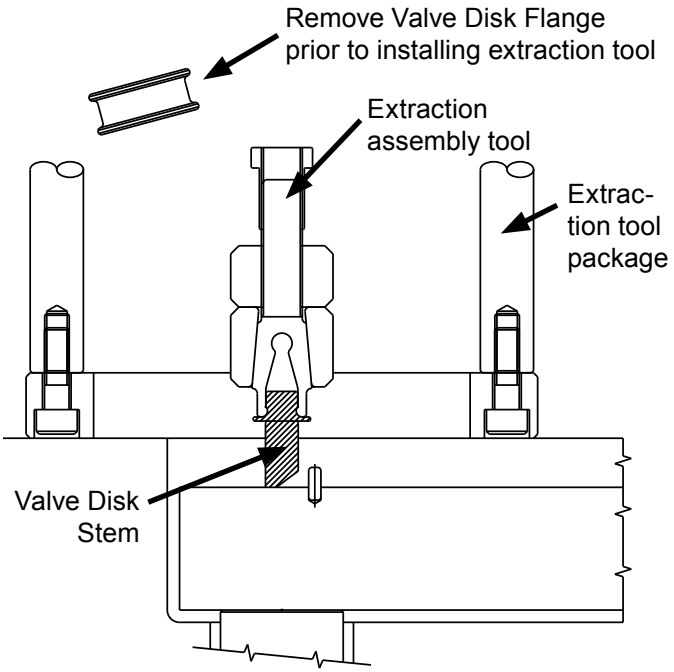
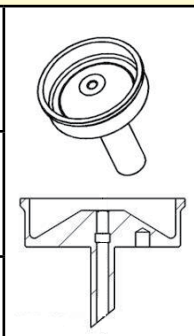
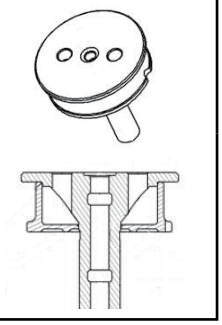
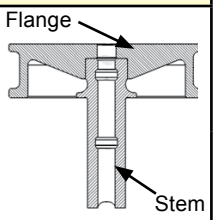

Remove Valve Disk Flange prior to installing extraction tool
Extraction assembly tool
Extrac-tion tool package
Valve Disk Stem

*Figure 12-2b 2-Pc Valve Disk Extraction Tool*

| EXTRACTION TOOLS | | |
|---|---|---|
| **Tool #** | **Where Used** | |
| EXTOOL07 | Ø35mm Valve Disks Non-Inverted Design |  |
| EXTOOL08 | Ø39mm Valve Disks Non-Inverted Design | |
| EXTOOL12 | Ø49mm Valve Disks Non-Inverted Design | |

| EXTRACTION TOOLS | | |
|---|---|---|
| **Part Number** | **Where Used** | |
| EXTOOL10P | 1-Pc Inverted Valve Style with 5mm x .8 thread; 13mm centre to centre |  |
| EXTOOL10P1 | 1-Pc Inverted Valve Style with 4mm x .7 thread; 13mm centre to centre | |

| EXTRACTION TOOLS | | |
|---|---|---|
| **Part Number** | **Where Used** | |
| EXTOOL17P | 2-Pc Inverted Style Ø7.74mm |  |
| EXTOOL18P | 2-Pc Inverted Style Ø10.74mm | |



## Terminal End Removal and Installation

Although this procedure shows a nozzle terminal end, the process is the same for manifold terminal ends.

### Terminal End Removal

1. If the terminal end is covered with plastic, warm the terminal end prior to removing the element sleeve.

**CAUTION**
Care must be taken when removing the element sleeve to avoid damage to the ceramic sleeve or terminal nut.

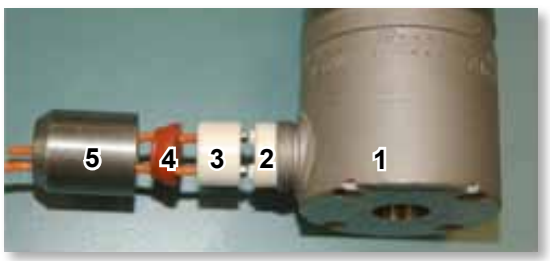



*Figure 12-3 Nozzle Terminal Assembly*
*1. Nozzle Flange 2. Ceramic Insert*
*3. Ceramic Sleeve 4. Seal 5. Element Sleeve*

2. Grip the element sleeve at the threaded area and turn counter clockwise. If the wires rotate with the sleeve, damage may result.
3. Remove the seal.
4. Remove the set screw from the ceramic sleeve.
5. Remove the power leads.

### Terminal Installation

Although this procedure shows a manifold, the process is the same for nozzle terminal ends.

**NOTE**

Please contact *Mold-Masters* Spare Parts Department to ensure you have the correct repair kit and crimping tool.The tools, along with the lead wire replacement kit, are available through the *Mold-Masters* Spare Parts Department.

## Terminal Assembly

1. Assemble the repair kit components.

*Figure 12-4*

2. Ensure the terminal end is clean.

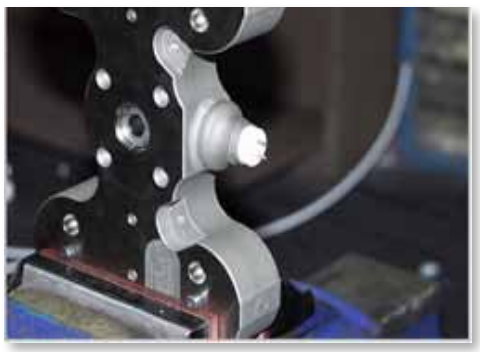


*Figure 12-5*

3. Slide the element sleeve, silicon seal and ceramic insulator onto the wires.

*Figure 12-6*

4. Slide crimps onto leads. Stranded wire should extend beyond the crimp.

*Figure 12-7*

5. Spread the wire strands and insert the lead wire onto the terminal posts.

*Figure 12-8*

6. Grasp the crimp with the crimping tool, slide the crimp into position over the terminal post and crimp the connection.

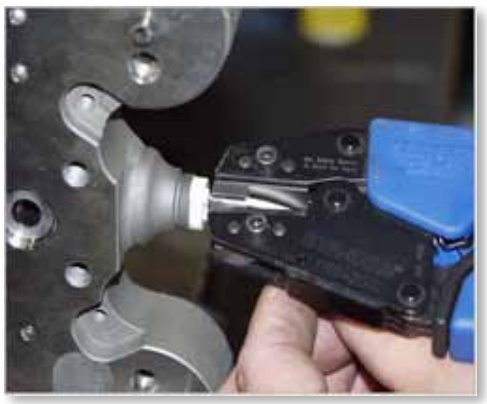


*Figure 12-9*

7. Slide the ceramic insulator and silicon seal into place.

*Figure 12-10*

8. Complete the repair by screwing the element sleeve into position.

**CAUTION**
Keep an eye on the silicon seal. It should not rotate with the sleeve or the wires may break.

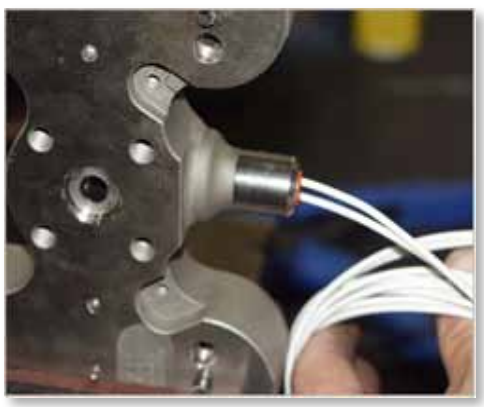


*Figure 12-11*

## Crimping Tool Chart

| Product Name | Description |
|---|---|
| PUNCHHANDLE01 | Ratchet tool for securing crimp to terminal end assemblies |
| CRIMPDIE01 | 4.0mm Heater Element (Mates with CRIMPPUNCH01) |
| CRIMPPUNCH01 | 4.0mm Heater Element (Mates with CRIMPDIE01) |
| CRIMPDIE02 | 2.5 - 3.0mm Heater Element (Mates with CRIMPPUNCH02) |
| CRIMPPUNCH02 | 2.5 - 3.0mm Heater Element (Mates with CRIMPDIE02) |
| CRIMPDIE03 | 1.8 - 2.0mm Heater Element (Mates with CRIMPPUNCH03) |
| CRIMPPUNCH03 | 1.8 - 2.0mm Heater Element (Mates with CRIMPDIE03) |
| CRIMPREMOVEB01 | Bottom Crimp Removal Insert for shearing HE crimps (Mates with CRIMPREMOVET01) |
| CRIMPREMOVET01 | Top Crimp Removal Insert for shearing HE crimps (Mates with CRIMPREMOVEB01) |

## Heater Plate Power Lead Replacement Removal

1. Remove the set screws.
2. Slide ceramic sleeve off.
3. Remove the power leads using crimp removal tool.

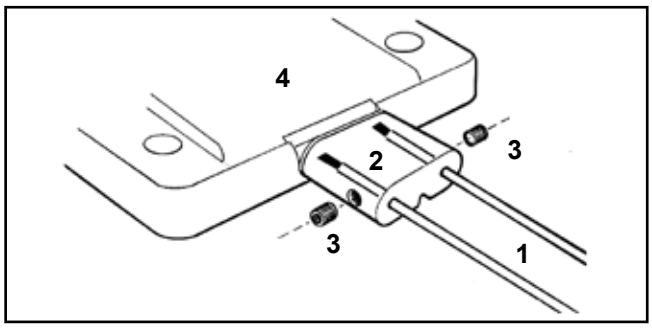



*Figure 12-12 Terminal Ends Assembly*
*1. Power Leads 2. Ceramic Sleeve 3. Set Screws*
*4. Heater Plate*

### Installation

1. Push the replacement leads into the holes in the ceramic sleeve.
2. Crimp the leads to the terminal ends.
3. Slide ceramic sleeve over the terminal end.
4. Tighten the set screws on the ceramic sleeve to secure the terminal assembly.

## Gate Seal Maintenance

### Reasons for Gate Seal Maintenance

- Tip damage
- Obstruction to melt flow
- Gate seal damage
- Tip wear

*Figure 12-13 Gate Seals*

### Multi-Cavity Systems

It is advisable to heat the system to ensure the temperature condition is met to remove the gate seals.

**NOTE**
Use the socket supplied in the *Mold-Masters* tool kit to loosen the gate seal.

It is recommended to use a temperature controller for this procedure. If a temperature controller is not available, contact your nearest *Mold-Masters* Service Department.

For gate seal installation and torquing procedures refer to "*Gate Seal Replacement*" section.

## Gate Seal Removal

The following procedure applies to all gate seals (including carbide) with threads larger than an M6 (Excluding TIT Edge).

**NOTE**
If the cavity plate is easily removed you can access the nozzle seals while still in the system.

Hot runner systems must be within 70°F (40°C) of mold temperature before the cavity plate can be removed. It is recommended the nozzle be removed from the system before removing the gate seal.

**CAUTION**
Seals and liners for MEX, Accu-Valve EX & CX are a sub-assembly utilizing a manufactured interference fit. Disassembly of this sub-assembly may affect alignment of the valve pin to the gate, causing wear.

**NOTE**
Use the socket supplied in the *Mold-Masters* tool kit to loosen the gate seal.

1. Apply penetrating lubricant to gate seal area.

**WARNING**
High temperature on the nozzle. Wear safety clothing such as heat-resistant coat and heat-resistant gloves. Failure to do so may cause serious injury.

**CAUTION**
The terminal end is a sensitive area and can easily break if not handled to specifications.

*Figure 12-14 Penetrating Lubricant*

2. Leave the nozzle in the mold or remove it to a vice and clamp carefully.
3. Using the temperature controller, heat the nozzle body until all residual plastic is melted from the gate area. If the nozzle is inside the mold, heat up the whole system and turn on the cooling or remove all O-rings.
4. While the nozzle is still hot, apply a loosening pressure to the gate using the socket to remove the seal.

*Figure 12-15 Remove Gate Seal*

5. Turn off the controller and wait for 5 minutes.
6. Remove the gate seals.

## Gate Seal Replacement

1. Clean the nozzle, especially the thread and runner.
2. Clean all residual plastic from the threads and counter bore of the gate seal.

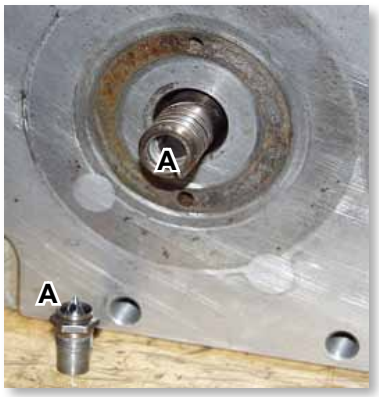



*Figure 12-16 (A) Cleaning Location*

**WARNING**
Ensure nozzles have cooled to room temperature. Failure to do so may cause serious injury.

**CAUTION**
It is critical that seal surface is perfectly clean. Failure to clean properly may result in nozzle and seal damage and leakage.

3. Check the bottom face of the nozzle counterbore for damage. If damaged, lap the bottom face of the nozzle in a circular fashion with a hardened tool and 300 grit lapping compound. If the nozzle counterbore is free of damage, proceed to step 5.

*Figure 12-17*

4. After lapping is complete, blue the liner to the nozzle to ensure proper mating. If the liner is making good contact, clean the bluing compound off both faces.

*Figure 12-18*

5. Apply anti-seize (nickel based) to the gate seal threads ONLY.

**CAUTION**
Carefully apply anti-seize to threads of the gate seal.
Any anti-seize that enters the internal runner must be removed to prevent contamination of melt.

*Figure 12-19*

6. Using a socket wrench, re-install the gate seal being careful not to damage it.
7. Torque the gate seal to the appropriate value. Refer to "*Gate Seal Torque Settings*".

**WARNING**
High temperature on the nozzle. Wear safety clothing such as heat-resistant coat and heat-resistant gloves. Failure to do so may cause serious injury.

8. Check that the seal has bottomed out, heat nozzle to process temperature and re-torque seal.

**WARNING**
Failure to torque the gate seals at processing temperatures may result in leakage.

## Sprint Gate Seal Maintenance

### Reasons for Gate Seal Maintenance

- Tip damage
- Obstruction to melt flow
- Gate seal damage
- Tip wear

*Figure 12-20 Sprint Gate Seal Components*

*Figure 12-21 Tool Kit for Gate Seal Maintenance*

It is advisable to heat the nozzle to ensure the temperature condition is met to remove the gate seal.

**CAUTION**
Use the socket supplied in the tool kit to loosen the gate seal.

## Sprint Nozzle Tip Removal

**CAUTION**
The hot runner system must be turned off and cooled to below 38ºC (100ºF) before cavity plate is removed. The cavity plate can then be removed to expose the nozzle tips.

1. After gate seals are exposed by removing the cavity plate, heat nozzles only until plastic softens in gate area (temperature will depend on resin used).
2. Apply loosening torque to the gate seal using 6 point socket provided (16mm socket). If the seal initially loosens, but then starts to bind, apply some industrial lubricant to remove the gate seal more easily.

*Figure 12-22 Loosening Gate Seal*

3. The gate seal, torpedo and insulator cap should come off the nozzle as an assembly. If the torpedo remains in the nozzle after the gate seal is removed, raise the nozzle temperature by 15ºC (25°F) or 5% power and remove the torpedo using soft jawed pliers.
4. Turn off heaters after gate seal removal.

## Sprint Nozzle Tip Installation

1. Clean all residual plastic from the nozzle threads and the torpedo/nozzle sealing surface.
2. Check the torpedo/nozzle sealing surface for damage. If damaged, lap the torpedo/nozzle sealing surface in a circular fashion with a hardened tool and 300 grit lapping compound.
3. After a smooth torpedo/nozzle contact surface is established, blue the torpedo to the nozzle surface to ensure proper mating.

*Figure 12-23 Applying blue to torpedo surface*

4. After ensuring good contact, clean bluing off both surfaces.
5. Apply nickel based anti-seize to the gate seal threads ONLY.
6. Install gate seal / liner into nozzle using 6 point socket provided. Torque gate seal to 25-28 ft lb (34-38 Nm) at process temperature.

*Figure 12-24 Torquing gate seal onto nozzle*

**WARNING**
Failure to torque the gate seals at processing temperatures may result in leakage.

## Cleaning Nozzle Insulator Cap

1. Heat cap with heat gun.
2. Remove molten plastic and wipe remainder from insulator cap.

*Figure 12-25 Cleaning Insulator Cap*

## Installing Nozzle Insulator Cap

1. Press fit insulator cap onto torpedo by hand.

*Figure 12-26 Installing Insulator Cap*

## Valve Actuator Maintenance

Please see Section 10 - Valve Actuators.

## Checking Nozzle Tip Height

1. Correct nozzle tip height and nozzle reference point is found on the gate detail of the general assembly drawing.
2. Assemble spacer blocks to same value as correct nozzle tip height.
3. Zero indicator to spacer blocks.

*Figure 12-27*

4. Move indicator to correct reference point on nozzle tip (per drawing).
5. Check that nozzle height is within drawing specification.
6. Repeat for each nozzle.

*Figure 12-28 Checking Nozzle Tip Height*

## Latching

### Introduction

There are two reasons latches are used in a mold:

- To tie the mold halves together for transportation and handling.
- To gain access between two mold plates which are screwed together during normal mold operation.

Latches are always used in pairs mounted on diagonally opposite sides of the mold to provide equal pull on the plates.

The latches are located on:

- The operator's side.
- Non-operator's side of the mold.
- Top and bottom of the mold.

Under no circumstances are plates to be pulled or handled with only one latch attached.

Latch locations are shown on the assembly drawings. During mold operation the latches must be removed from the mold and stored elsewhere.

### Latching the Cavity Plate to the Core Half (Cold Half)

Use this procedure for reference purposes only. For latch locations, refer to the assembly drawings.
For additional instructions on latching in the machine refer to the machine manufacturers manual.

**WARNING**
Make sure the machine has been locked out and tagged out in accordance to the machines documented procedures. Failure to do so may lead to serious injury or death.

1. Open the mold.
2. Ensure that the machine and hot runner controller has been locked out and tagged out.
3. Apply lock out / tag out to the machine power source and hot runner controller. Refer to the controller and machine manufacturers documentation for procedures.
4. Allow the mold to cool to room temperature. Continue to circulate the mold cooling water in all plates to cool the mold more quickly.

**WARNING**
Make sure the lifting eyebolt, lifting chain and crane are rated to adequately support the weight of the plate(s). Failure to do so could cause serious injury.

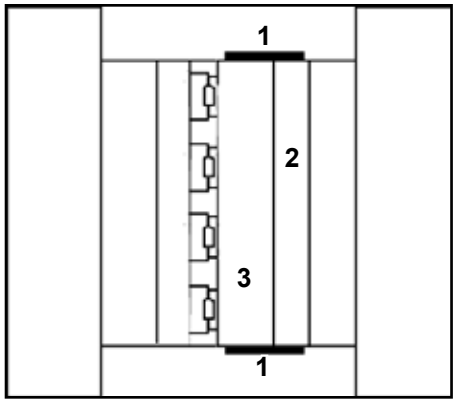



*Figure 12-29*
*1. Latches 2. Manifold Plate 3. Cavity Plate*

5. If the mold has no leader pins, attach a crane that is rated to adequately support the weight of the cavity plate.

**WARNING**
Install latches before removing the cavity plate mounting screws. Failure to do so may lead to serious injury or death.

6. Latch the cavity plate to the manifold or manifold backing plate.
7. Check that the cavity plate hoses are long enough to allow the cavity plate to be latched over to the core half (cold half), without damaging the hoses.
8. Remove all cavity plate mounting screws.
9. Remove lockout / tagged out.
10. Place the machine in Mold Set mode.
11. Close the mold slowly.

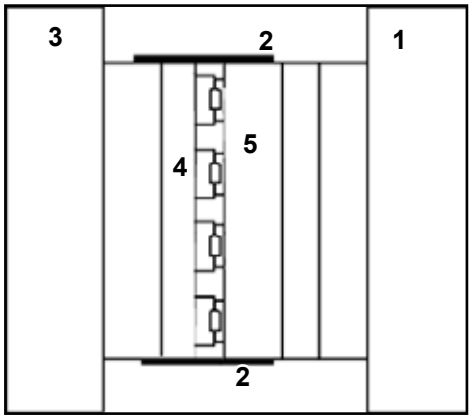



*Figure 12-30 Cavity Plate to Core Plate*
*1. Stationary Platen 2. Latches*
*3. Moving Platen 4. Core Plate 5. Cavity Plate*

**WARNING**
Make sure the machine has been locked out and tagged out in accordance to the machines documented procedures. Failure to do so may lead to serious injury or death.

12. Apply lockout / tagged out. Refer to machine manufacturers documentation for procedures.
13. Remove the latches.
14. Latch the cavity plate to the core plate or cold half.
15. Remove lockout / tagged out.
16. Check the machine is in Mold Set mode.
17. Open the mold moving the cavity plate away from the manifold plate.

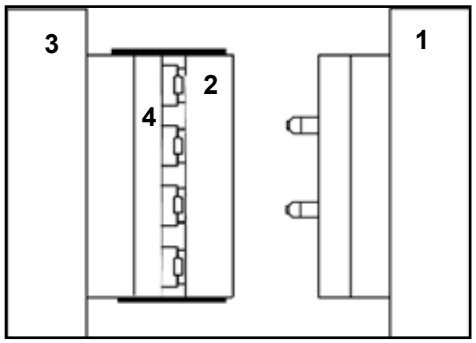



*Figure 12-31 Latch Cavity Plate to Core Plate*
*1. Stationary Platen 2. Cavity Plate*
*3. Moving Platen 4. Core Plate*

18. Apply lockout / tagged out. Refer to the controller and machine manufacturers documentation for procedures.

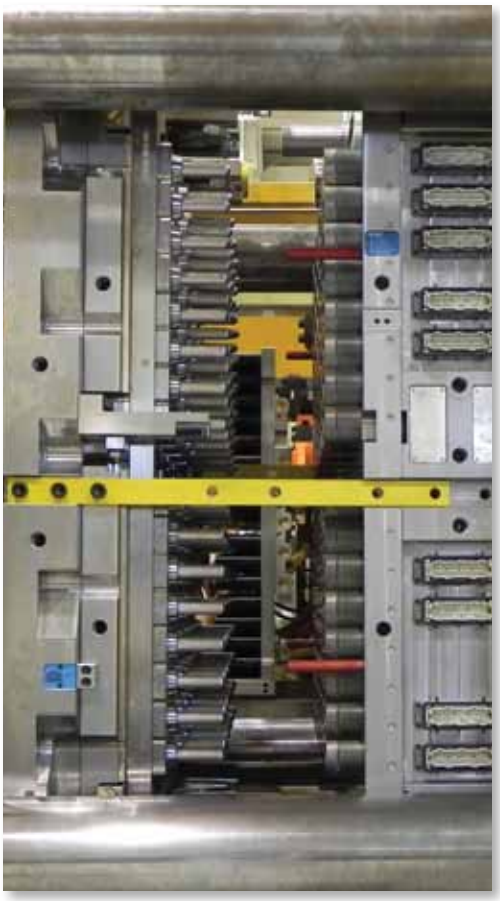
**CAUTION**
The nozzles must be within 100°F (55°C) of mold temperature to prevent damage to hot runner and mold components. For cylindrical valve gated systems, valve pins should be in the open position prior to removal of the cavity plate to prevent damage.

# Latching the Cavity Plate to the Manifold Plate (Hot Half)

**WARNING**
Make sure the machine has been locked out and tagged out in accordance to the machines documented procedures. Failure to do so could lead to serious injury or death.

**CAUTION**
The nozzles must be within 100°F (55°C) of mold temperature to prevent damage to hot runner and mold components. For cylindrical valve gated systems, valve pins should be in the open position prior to removal of the cavity plate to prevent damage.

1. Check the machine is locked out / tagged out.
2. Lubricate the guide pins on the hot half.
3. Remove lock out / tag out.
4. Check the machine is in Mold Set mode.
5. Slowly close the mold.
6. Check the machine has been locked out / tagged out. Refer to the controller and machine manufacturers documentation for procedures.
7. Remove the latches on both sides of the mold.
8. Latch the cavity plate to manifold plate or manifold backing plate.
9. Remove lock out / tag out.
10. Open the mold.
11. Check the machine has been locked out / tagged out. Refer to the controller and machine manufacturers documentation for procedures.
12. Install and torque the cavity plate mounting screws. Torque to required specifications, refer to assembly drawings for required torque settings.
13. Install hoses if required.
14. Remove latches from both sides of the mold.



# Torque Settings

## Gate Seal Torque Settings

| Seal Torque Settings | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Gating Method | Femto-Lite | | Femto | | Pico | | Centi | | Deci | | Hecto | |
| | Nm | ft-lb | Nm | ft-lb | Nm | ft-lb | Nm | ft-lb | Nm | ft-lb | Nm | ft-lb |
| E-Type Torpedo | 8-9 | 6-7 | 8-9 | 6-7 | 16-18 | 12-13 | 27-30 | 20-22 | 34-38 | 25-28 | 47-54 | 35-40 |
| Ext. E-Type Torpedo | 8-9 | 6-7 | | | | | | | | | | |
| F-Type Torpedo | 8-9 | 6-7 | 8-9 | 6-7 | 16-18 | 12-13 | 27-30 | 20-22 | 34-38 | 25-28 | 47-54 | 35-40 |
| Hot Sprue | | | 8-9 | 6-7 | 16-18 | 12-13 | 27-30 | 20-22 | 34-38 | 25-28 | 47-54 | 35-40 |
| Extended Hot Sprue | | | | | 16-18 | 12-13 | 27-30 | 20-22 | 34-38 | 25-28 | 47-54 | 35-40 |
| Hot Valve | | | 8-9 | 6-7 | 16-18 | 12-13 | 27-30 | 20-22 | 34-38 | 25-28 | 47-54 | 35-40 |
| Bi-Metallic C-Sprue | | | | | 16-18 | 12-13 | 27-30 | 20-22 | 34-38 | 25-28 | 47-54 | 35-40 |
| Bi-Metallic Cylindrical Valve | | | 8-9 | 6-7 | 16-18 | 12-13 | 27-30 | 20-22 | 34-38 | 25-28 | | |
| Bi-Metallic C-Valve | | | | | 16-18 | 12-13 | 27-30 | 20-22 | 34-38 | 25-28 | 47-54 | 35-40 |
| Spiral Hot Tip | | | | | 16-18 | 12-13 | 27-30 | 20-22 | 34-38 | 25-28 | 47-54 | 35-40 |
| Accu-Valve™ | | | 8-9 | 6-7 | 16-18 | 12-13 | 27-30 | 20-22 | 34-38 | 25-28 | | |
| TIT Edge | | | | | 11-14 | 8-10 | 14-15 | 10-11 | 14-15 | 10-11 | | |
| Multi Tip | | | | | | | 16-18 | 12-13 | 27-30 | 20-22 | | |
| Horizontal Hot Tip | | | | | | | 15-18 | 11-13 | 15-18 | 11-13 | | |
| C-Sprue | 8-9 | 6-7 | 8-9 | 6-7 | | | | | | | | |
| C-Valve | | | 8-9 | 6-7 | | | | | | | | |

**NOTE**
Gate seals are to be torqued at ambient (room) temperature and then re-torqued at processing temperature to the torque value specified. This is to prevent material leakage from the gate seal.

## System Screw Torques

Quality and length of screws must be as specified on *Mold-Masters* general assembly drawings.

| Torque Chart for System Assembly Screws | | | |
|---|---|---|---|
| Metric | Torque Setting | Imperial | Torque Setting |
| M5 | 7 Nm | #10-32 | 5 ft lbs |
| M6 | 14 Nm | 1/4-20 | 10 ft lbs |
| M8 | 20 Nm | 5/16-18 | 15 ft lbs |
| M10 | 40 Nm | 3/8-16 | 30 ft lbs |
| M12 | 60 Nm | 1/2-13 | 45 ft lbs |
| M16 | 145 Nm | 5/8-11 | 107 ft lbs |
| M20 | 285 Nm | 3/4-10 | 210 ft lbs |

*Exception to the above - bridge manifold mounting screws should be torqued 1/3 higher then specified on general assembly drawings.

| Torque Chart for Plate Assembly Screws | | | |
|---|---|---|---|
| Metric | Torque Setting | Imperial | Torque Setting |
| M5 | 10 Nm / 7 ft lbs | #10-32 | 9 Nm / 6 ft lbs |
| M6 | 16 Nm / 12 ft lbs | 1/4-20 | 22 Nm / 16 ft lbs |
| M8 | 39 Nm / 29 ft lbs | 5/16-18 | 48 Nm / 35 ft lbs |
| M10 | 77 Nm / 57 ft lbs | 3/8-16 | 85 Nm / 63 ft lbs |
| M12 | 135 Nm / 100 ft lbs | 1/2-13 | 209 Nm / 154 ft lbs |
| M16 | 330 Nm / 243 ft lbs | 5/8-11 | 384 Nm / 283 ft lbs |
| M20 | 650 Nm / 479 ft lbs | 3/4-10 | 678 Nm / 500 ft lbs |

| Component Torque Settings | |
|---|---|
| **Valve Actuator** | |
| Series 5500, 6500, 6600 and 6700 | Torque Setting |
| Piston Top | 20-27 Nm(15-20 ft-lbs) |

**NOTE**

Torque sequence and step torquing:
It is recommended that system screws be torqued in a standard bolt pattern and that the specified torque is achieved in 3 steps (1/3, 2/3 and full torque).

# Section 13 - TIT Edge Gated System

## Introduction

The following section contains procedures on non-standard components.

## TIT Edge Gated System

Edge gated systems are supplied with gate seals that are oversize. They must be ground prior to installing the nozzle into the nozzle well bore. (Minus heat expansion).

**NOTE**

Exception - gate seals supplied without the gate. The gate must be placed into gate seal after the seal is ground to the final dimension. Refer to gate detail on the general assembly drawing.

**NOTE**

Heat expansion of the nozzle must also be taken in to consideration.

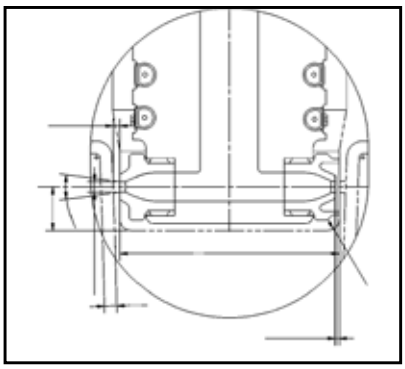


*Figure 13-1 TIT Edge Gated System*

## TIT Edge Gate Seals

The following procedure applies to TIT Edge nozzles only. The gate seal have an M6 thread.

### Removing the Gate Seal

**NOTE**

If the cavity plate is easily removed you can access the nozzle seals while still in the system. Hot runner systems must be cold before the cavity plate can be removed.

1. Apply penetrating oil to the threads.
2. Heat the nozzle to processing temperature to melt any residual plastic that may be in the gate seal area.
3. When the nozzle approaches set temperature, use *Mold-Masters* supplied socket to remove the seal.

**NOTE**

Cylindrically ground gate seals cannot be reinstalled.

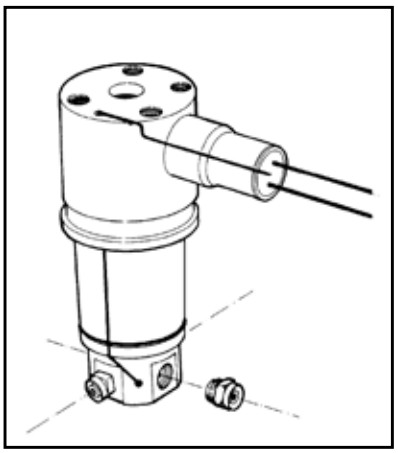


*Figure 13-2 TIT Edge Gate Seal*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# Section 14 - Accu-Line System

Accu-Line™

## Accu-Line Body Assembly

1 - Socket Head Cap Screw
2 - Actuator Cylinder Top
3 - O-Ring, Viton
4 - O-Ring, Viton
5 - Guide Ring
6 - O-Ring, Viton
7 - Guide Ring
8 - Actuator Piston
9 - Outer Cylinder Housing
10 - Socket Head Cap Screws
11 - Actuator 24" Con. Hose w/Fittings
12 - Actuator Heated Body
13 - Actuator Valve Pin Holder
14 - Socket Head Cap Screws
15 - Valve Pin
16 - Dowel Pin
17 - Socket Head Cap Screw
18 - Accu-Line Bushing
19 - Nozzle
20 - Liner
21 - Gate Seal

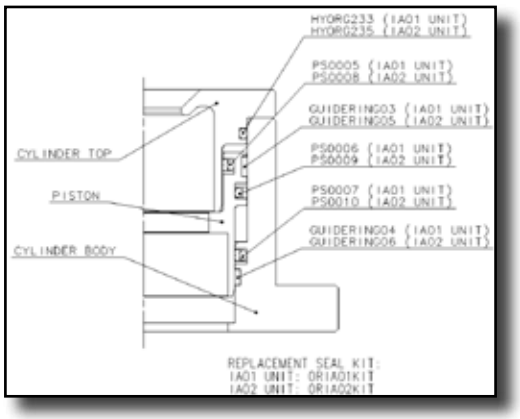
REFER TO GENERAL ASSEMBLY DRAWINGS FOR ACTUAL SIZES

**Piston Parts List:**

A) HYORGxx (Viton o-ring)

B) PS00xx (3 piece piston seals)
Each containing: 1 – Backup ring with split
1 – Viton o-ring
1 – Hard ring

C) GUIDERINGxx (Guide ring)



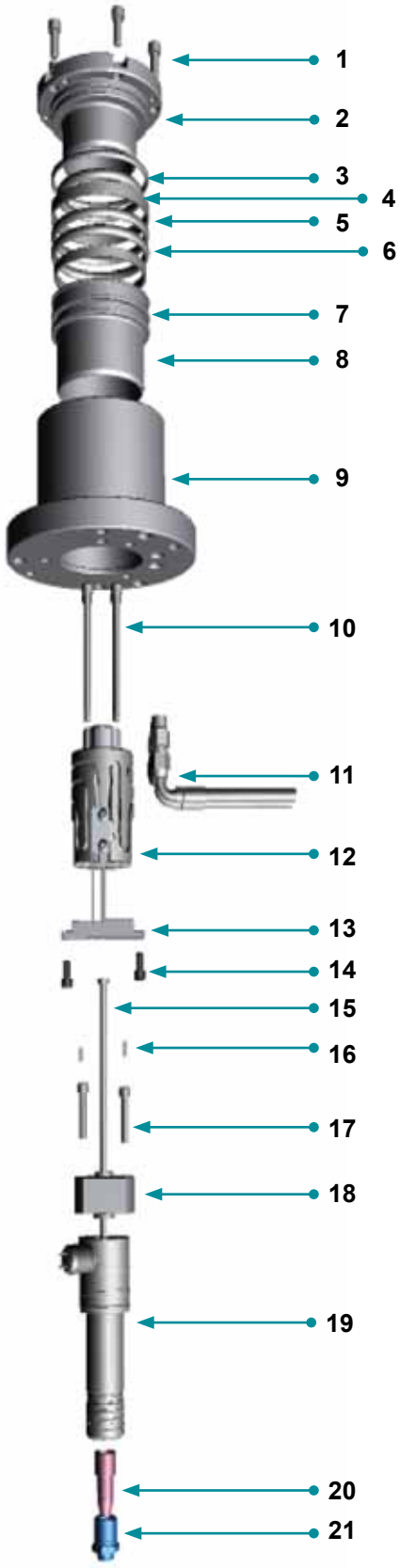




*Figure 14-1 Accu-Line Body Assy*

## Pre-Assembly

1. Cut pin to calculated length, as specified in the general assembly drawing. Refer to "*Valve Pin Finishing of Tip*".

## Accu-Line Assembly Procedure

1. Check components against the parts list.

*Figure 14-2*

2. Put cylinder backup washer and O-ring into cylinder body groove. Bend the cylinder hard ring into a kidney shape and insert into position in cylinder body.

*Figure 14-3*

3. Carefully push the protruding segment of the hard ring into the groove and reshape it using your finger. Make sure it seats firmly in the groove.

*Figure 14-4*

4. Repeat steps 1 - 3 to install inner seal into the piston.

*Figure 14-5*

5. Install piston backup washer and O-ring into the designated outer groove. The back up washer should be placed on the shorter side of the piston. Place one side of piston hard ring into position and using your fingers carefully push it into the groove. Apply small amount of lubrication to O-ring and the inner side of the hard ring to help assembly.

**CAUTION**
Do not use any tools. This may cause overstretching of the hard ring.

*Figure 14-6*

6. Insert piston (with seals and guide ring) into the cylinder body (with seal and guide ring). Apply a small amount of lubrication to all outside faces of seals prior to this step to help assembly.

*Figure 14-7*

7. Ensure that timing marks on both components are aligned.

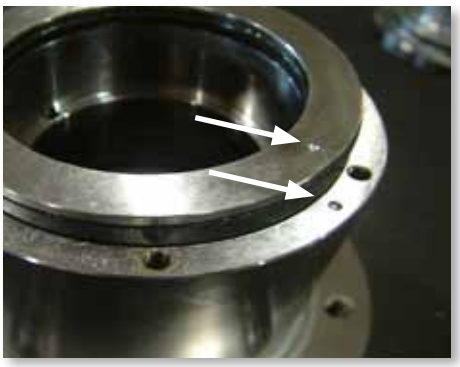


*Figure 14-8*

8. Make sure installed seals engage into guiding chamfer. Press piston smoothly and gently, applying even force.

*Figure 14-9*

9. Insert O-ring into cylinder top and assemble it to cylinder body.

*Figure 14-10*

10. Torque fasteners to specifications detailed in GA drawings.

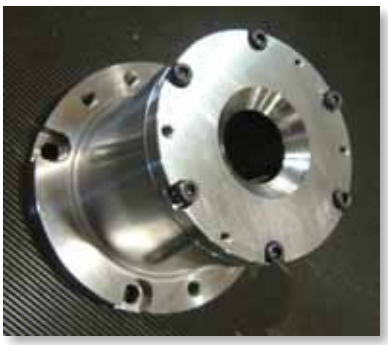


*Figure 14-11*

11. Turn assembled unit over and attach actuator connection hose fittings to the supply ports. Tighten to specifications detailed in the GA drawing.

*Figure 14-12*

12. Attach gate seal and liner to nozzle. Tighten to specs detailed in the GA drawings. Attach nozzle thermocouple.

*Figure 14-13*

13. Attach valve bushing. Tighten to specifications detailed in the GA drawing.

*Figure 14-14*

14. Slide the valve pin into the nozzle assembly.

*Figure 14-15*

15. Attach the 2 hollow sleeves to the valve bushings (Hecto nozzles only).

*Figure 14-16*

16. Attach the heater body over the assembly. Tighten to specifications detailed in the GA drawing. The thermocouple can be inserted by removing the wire retainer holding terminal end and bending into the thermocouple groove.

*Figure 14-17*

17. Slide the valve pin holder into the heater body slot and over the valve pin head.

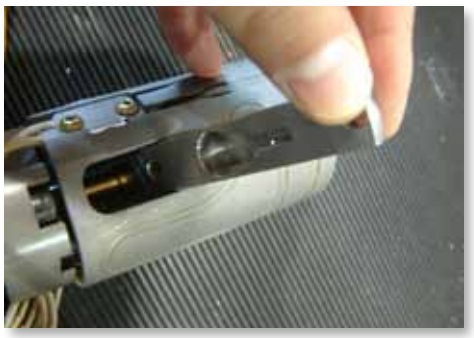


*Figure 14-18*

18. The valve pin holder should be locked with and move together with the valve pin.

*Figure 14-19*

19. Carefully place the nozzle assembly into the hydraulic unit as shown.

*Figure 14-20*

20. Ensure that the nozzle terminal end is correctly oriented.

*Figure 14-21*

21. Secure the valve pin holder to piston. Tighten to specifications detailed in the GA drawing.

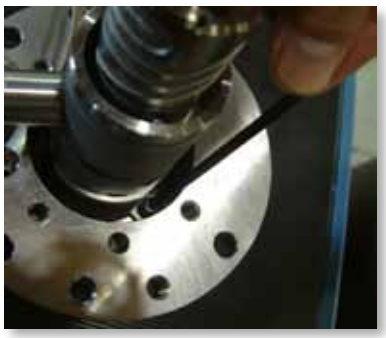


*Figure 14-22*

22. Assemble inside mold and verify assembly and all connections for accuracy.

*Figure 14-23*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# Section 15 - Melt-Disk System

# Melt-Disk®

## Introduction

We would like to take this opportunity to thank you for purchasing a *Mold-Masters* Melt-Disk system. The purpose of this manual is to assist users in the integration, operation and maintenance of *Mold-Masters* systems. This manual is designed to cover most system configurations. For additional information, please contact your representative or a *Mold-Masters* office.

## Safety

**Please see Section 3 for important safety information.**

The responsibility for the safety of personnel remains exclusively with the employer. It is the obligation of the employer to properly train and instruct its personnel in the safe operation of equipment including maintenance and the purpose and proper use of all the safety devices. In addition, the employer must provide its personnel with all necessary protective clothing, including such items as a face shield and heat resistant gloves. Any instructional material provided by *Mold-Masters* for the operation and maintenance of equipment, does not in any way absolve the employer from fulfilling these obligations and *Mold-Masters* disclaims liability for injury to personnel using equipment supplied.

### Notices

Notices throughout this manual indicate additional information that must be performed or observed.

**WARNING**
Safety warning indicates a potentially hazardous situation, which if not avoided, could result in serious injury or death.

**CAUTION**
Caution indicates that damage to equipment is possible.

**NOTE**
Important indicates useful additional information or is used as a reminder for important information.

# System with cast in heater element

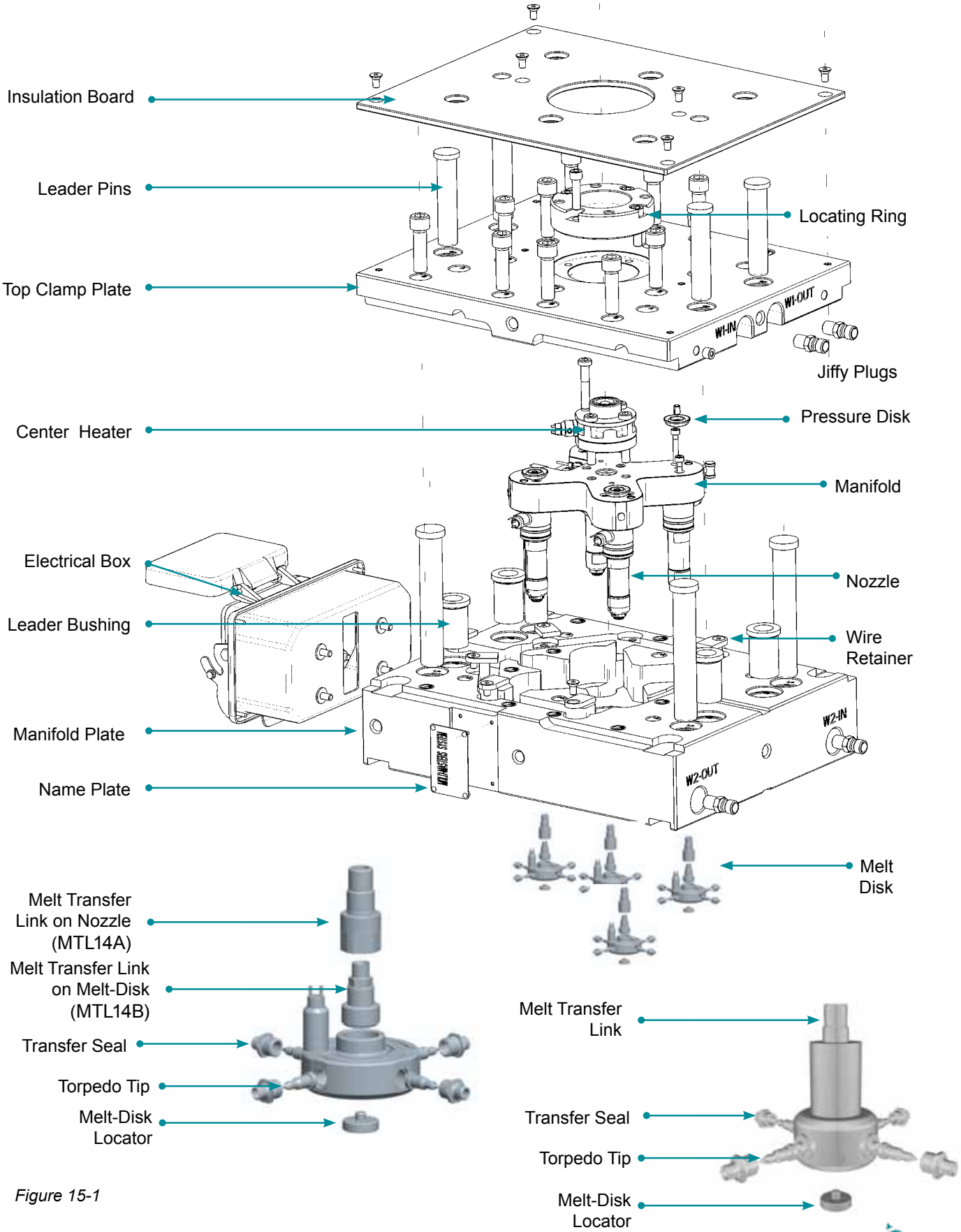


*Figure 15-1*

## Melt-Disk Preparation / Cleaning

All nozzles, manifolds and components must be free of the rust inhibitor applied at the factory.

1. Disassemble the Melt-Disk assembly.
2. Wipe down the Melt-Disk.
3. Remove the part and wipe clean. If necessary, use a cotton swab to clean narrow interior surfaces or screw threads. For larger surfaces, such as mold plates use thinner in spray form to clean channels and recesses.

*Figure 15-2 Clean Parts*

4. Anti-seize the threads of the gate seals, using *Mold-Masters* supplied compound.

*Figure 15-3 Anti-Seize Compound Application*

5. Insert the pointed end of the tips (torpedoes) into the threaded end of the gate seal.

*Figure 15-4 Assembling Gate Seal*

6. Thread the gate seal assembly into the Melt-Disk. Secure the Melt-Disk in a soft vice and torque gate seals in the cold condition to value specified below or in the General Assembly Drawings. Do not over tighten the vice. Ensure none of the components are damaged.

| Thread size | Imperial | Metric |
|---|---|---|
| M9 | 10 - 11 ft lbs | 14- 15 Nm |

7. Torque gate seals in heated condition at processing temperature as specified in the general assembly drawings.

**CAUTION**
Failure to torque the gate seals at processing temperatures may result in leakage.

*Figure 15-5 Torquing  Gate Seals*

## Nozzle Thermocouple Assembly

1. Although not necessary, a thermal compound may be applied to the tip of the thermocouple.
2. Connect the thermocouple a's specified in the general assembly diagram.  See also "Section 5 -*Assembly*".

## Melt-Disk Thermocouple Assembly

1. Remove the thermocouple retaining screw from the Melt-Disk.

*Figure 15-6*

2. Insert the thermocouple tip into the thermocouple hole.  Thermocouple must bottom out in the hole.

*Figure 15-7*

3. Bend the thermocouple back 90°.

*Figure 15-8*

4. Secure the thermocouple with the screw from #1.

*Figure 15-9*

5. Use heat resistant tape to secure the nozzle wires and thermocouple wires just above the insulator pod.

*Figure 15-10*

6. Prepare all remaining Melt-Disks the same way and set aside.

*Figure 15-11*

## Optional Quick Disconnect Terminal Ends

Optional quick disconnect terminal end kits are available on request. The kit consists of:

- QDISC-CRIMP Tool
- TERMCON09 (Power)
- TERMCON10 (Thermocouple)

*Figure 15-12: Power Quick Disconnect Terminal Ends*

*Figure 15-13: Thermocouple Quick Disconnect Terminal Ends*

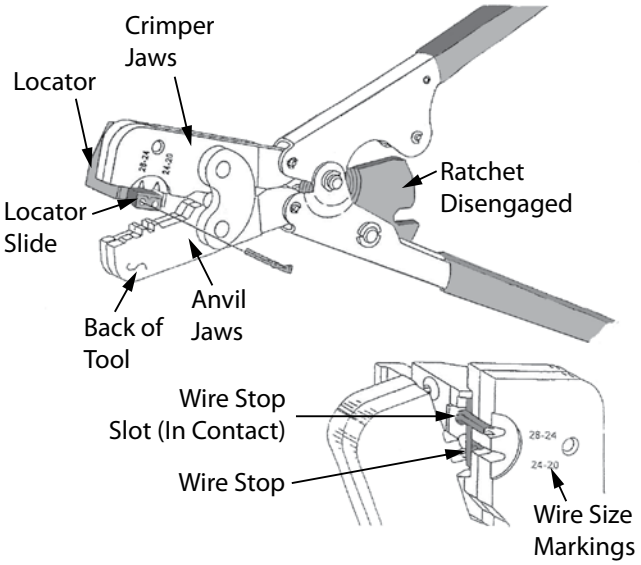


*Figure 15-14: QDISC-CRIMP Tool*

### Crimping the Quick Disconnects

Select the appropriate loose-piece contact and identify the crimp cavity according to the wire size markings on the tool.

1. Hold tool so wire side is facing you. Make sure ratchet is released. Squeeze tool handles together and allow them to open fully.
2. Grasp locator and simultaneously move locator toward anvil jaws and push locator slide into crimper jaws. Spring tension will hold locator position against crimper jaws.
3. Insert contact mating end into appropriate hole in locator slide. Orient contact so wire barrel and insulation barrel are facing crimper jaws (wire size markings).

**CAUTION**
Do not attempt to close tool handles when locator slide is positioned between crimping jaws - damage to the tool jaws and/or locator slide may result.

4. Pull locator slide out of crimping jaws. Spring tension will pull locator down and allow wire stop to enter the slot between barrel and contact shoulder.

**CAUTION**
Make sure both sides of the insulation barrel are started evenly into the crimper jaws - do not attempt to crimp an improperly positioned contact.

5. Squeeze tool handles together until ratchet engages. Do not deform insulation barrel or wire barrel.
6. Insert properly stripped wire contact into the wire barrel until wire butts against the wire stop.

7. Holding wire in place, squeeze tool handles together until ratchet releases. Allow tool handles to open fully. Move locator toward anvil jaws and remove crimped contact.

**Assembling the System with Quick Disconnects**

1. When assembling the system, connect female and male connector pins.
2. Then screw male sleeve into female sleeve.

# Assembly of Melt Disk to the Nozzle

## Two-piece Melt Link

1. Anti-seize the threads of the Melt link using *Mold-Masters* supplied compound.

*Figure 15-15*

2. Thread Melt link MTL14A into the nozzle and Melt Link MTL14B into the Melt-Disk.

*Figure 15-16*

3. Torque COLD to 20-22 Ft lbs (27-30 Nm).
4. Assemble Melt-Disks onto the nozzles according to mold design via the Melt link.
5. Ensure the sharp edge of the melt link does not get damaged when pushing the two halves together.

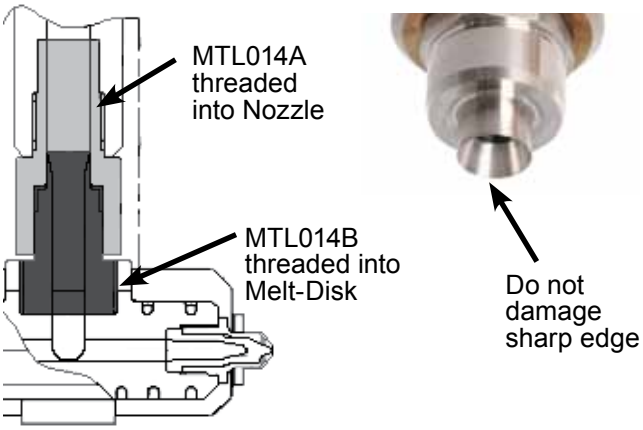


*Figure 15-17*

## One-piece Melt Link

1. Anti-seize the threads of the 1pc Melt link, using *Mold-Masters* supplied compound.

*Figure 15-18*

2. Thread the Melt link into the nozzle.

*Figure 15-19*

3. Torque the Melt link COLD to the value specified in the general assembly diagram.
4. Assemble Melt-Disks onto the nozzles according to mold design.
5. Ensure the sharp edge of the melt link does not get damaged.

*Figure 5-20*

## Melt-Disk System Start Up & Shut Down

**Also refer to Section 8 System Start Up & Shut Down and the controller manual.**

### Start Up

**NOTE**
When running thermally sensitive materials, use a thermally stable material as recomended by the material supplier for the initial start up.

1. Turn on the machine barrel and mold cooling system.
2. Prior to start up, ensure the:
   - Machine barrel is up to processing temperature.
   - Mold cooling is on and at cooling temperature.
3. Heat manifold zones and Inlet to processing temperature.
4. Heat Melt-Disks to processing temperature.
5. Heat nozzles to processing temperature. A small amount of material may weep at this stage.
6. Allow to heat soak at least 10 minutes.
7. Fill system under low pressure extrude (using screw rotation).
8. Set Melt-Disk temperature at least 10°F lower than nozzles.

**NOTE**
For hot runner systems using heater plates, allow 10 minutes of soak time after the system reaches processing temperature.

**CAUTION**
Failure to follow the above procedure may result in leakage/damage occurring in the hot runner.

**WARNING**
When the mold is open never inject material through hot runner system under high pressure. Failure to do so can result in serious injury or death.

### Shut Down

**NOTE**
For horizontal tips, refer to the controller operating manual.

1. Maximize decompression stroke prior to shut down. This will minimize drool at start up when there is limited gate cooling.
2. Reduce nozzle temperatures to 300°F (150°C).
3. Reduce Melt-Disk temperatures to 300°F (150°C).
4. Turn off all zones.

**NOTE**
Thermally sensitive materials should be purged from the hot runner system prior to shut down using a thermally stable material with a similar processing temperature. For example, a system running PVC should be initially started and subsequently shut down on LDPE.

## Disassembly for Maintenance

**NOTE**
Before shutting down the molding machine and mold, use maximum screw decompression to remove as much molten plastic from the hot runner system as possible.

1. Disassemble mold to expose the Melt-Disk. Plate/insert removal to be done with all components in the cold condition.
2. Melt-Disks should be heated to 250 - 280ºF before removal. The Melt-Disk should be removed as soon as it reaches set-point. The EXTOOLAS01 can be used to assist with the Melt-Disk removal.

## Melt-Disk Reassembly after Maintenance

1. All sealing surfaces are to be clean and inspected for defects.
2. The inside bore of the Melt-Disk is to be free of material so that when it is installed to the Melt link, there is no interference.
3. The Melt-Disk is to be installed cold onto a cold Melt link.

# Section 16 - Melt-Cube System

## Introduction

We would like to take this opportunity to thank you for purchasing a *Mold-Masters* Melt-Cube system. The purpose of this manual is to assist users in the integration, operation and maintenance of *Mold-Masters* systems. This manual is designed to cover most system configurations. For additional information, please contact your representative or a *Mold-Masters* office.

## Safety

**Please see Section 3 for important safety information.**

The responsibility for the safety of personnel remains exclusively with the employer. It is the obligation of the employer to properly train and instruct its personnel in the safe operation of equipment including maintenance and the purpose and proper use of all the safety devices. In addition, the employer must provide its personnel with all necessary protective clothing, including such items as a face shield and heat resistant gloves. Any instructional material provided by *Mold-Masters* for the operation and maintenance of equipment, does not in any way absolve the employer from fulfilling these obligations and *Mold-Masters* disclaims liability for injury to personnel using equipment supplied.

### Notices

Notices throughout this manual indicate additional information that must be performed or observed.

**WARNING**
Safety warning indicates a potentially hazardous situation, which if not avoided, could result in serious injury or death.

**CAUTION**
Caution indicates that damage to equipment is possible.

**NOTE**
Important indicates useful additional information or is used as a reminder for important information.


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# Melt-Cube Components

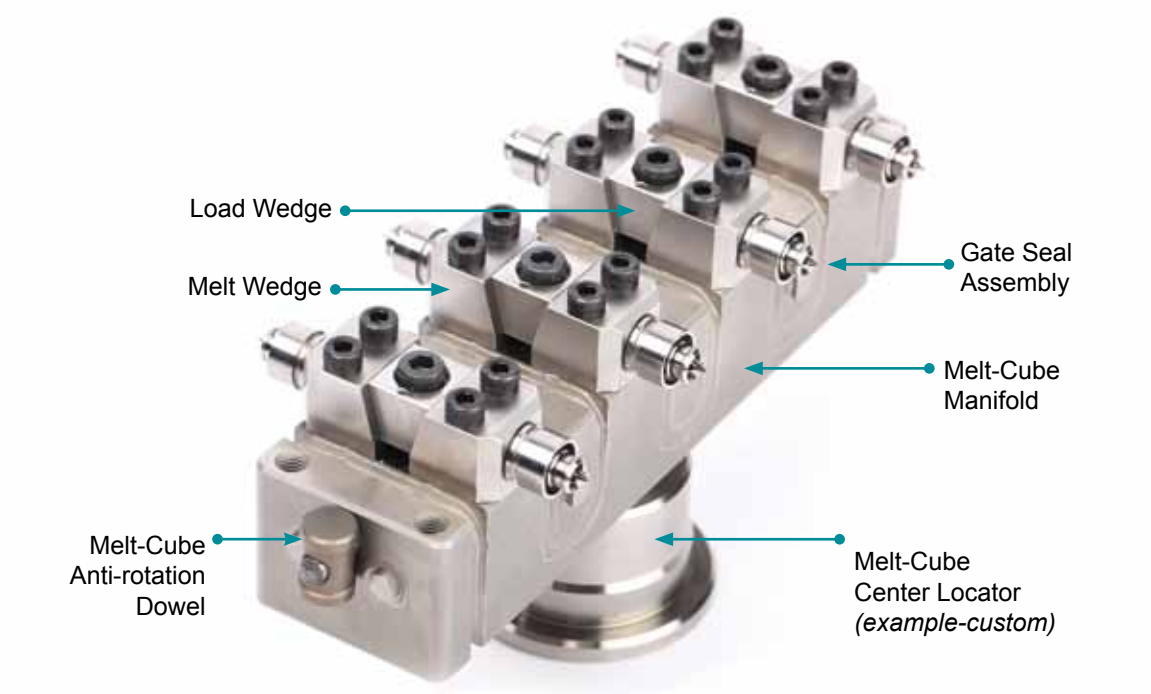

*Figure 16-1*

# Example Melt-Cube System

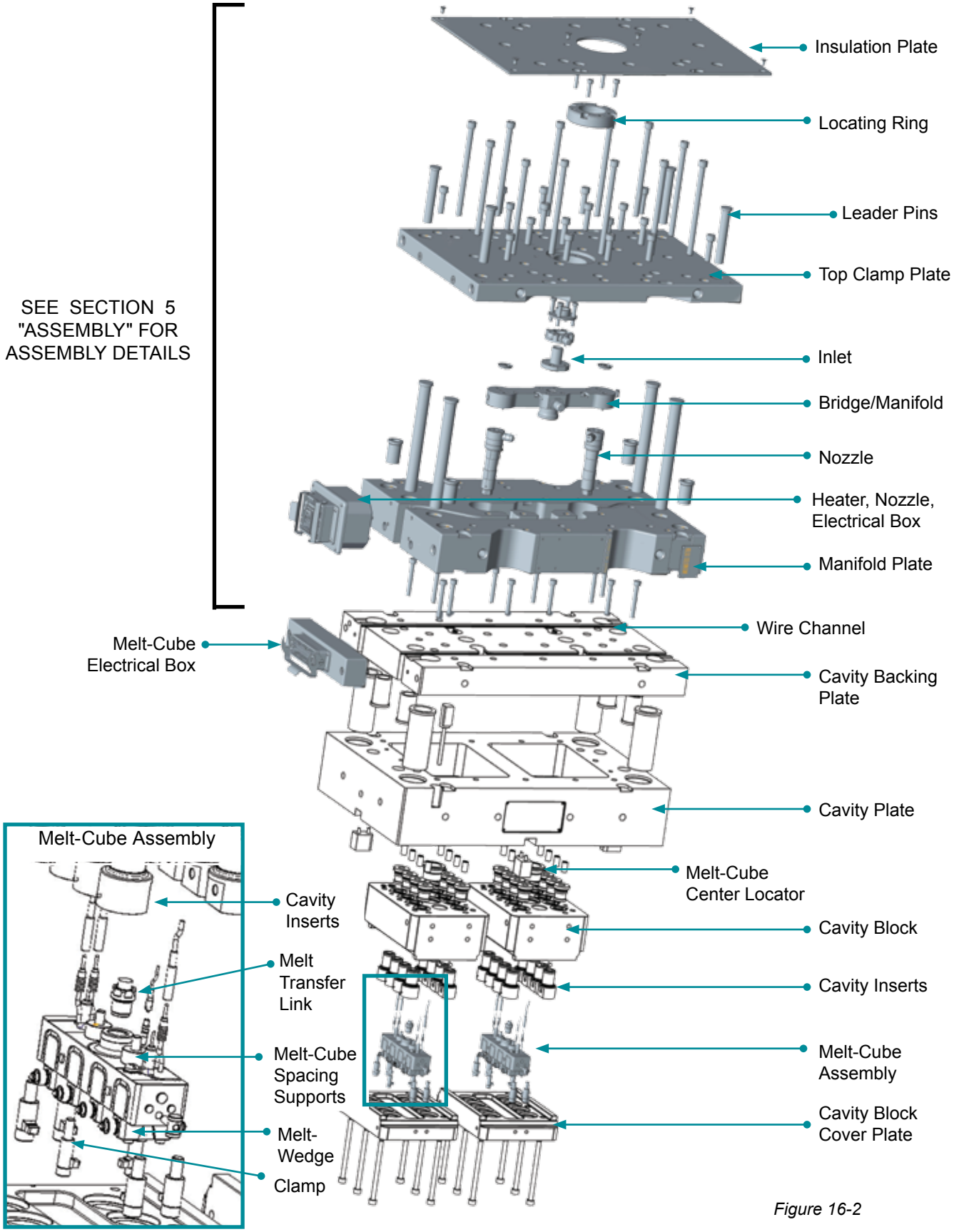


*Figure 16-2*

# Preparation

## Inspection

1. Inspect critical dimensions for cavity cutout to ensure it matches the GA drawing and catalogue pages.

## Clean Melt-Cube

1. Wipe down the Melt-Cube.
2. If necessary, use a cotton swab to clean narrow interior surfaces or screw threads. For larger surfaces, such as the manifold, use thinner in spray form to clean channels and recesses.

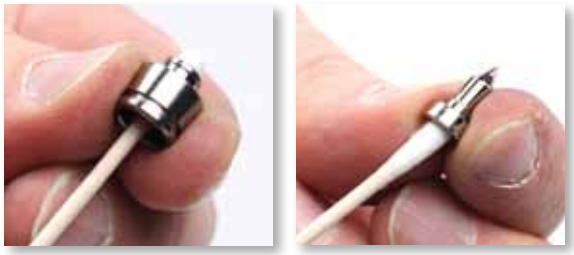

*Figure 16-3*

## Assemble Melt-Cube Thermocouple

1. Insert the thermocouple tip into the thermocouple hole. Thermocouple must bottom out in the hole.

*Figure 16-4*

2. Bend the thermocouple back 90° to sit in the manifold channel.
3. Apply anti-seize to the retaining screw. Secure the thermocouple with the screw.

*Figure 16-5*

## Assemble Ground Wire

1. Apply anti-seize to the retaining screw. Secure the ground wire with the screw.

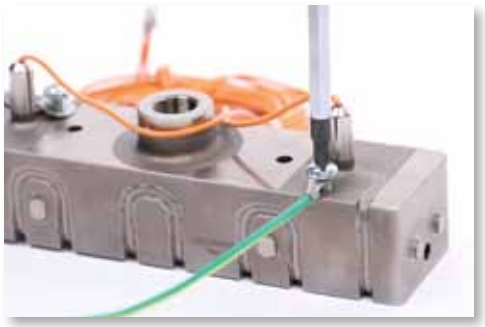

*Figure 16-6*

## Assemble Melt Transfer Link to Melt-Cube

1. Anti-seize the threads of the Melt Transfer Link (Top half and bottom half).

*Figure 16-7*

2. Thread the Melt Transfer Link bottom half into the Melt-Cube and the Melt Transfer Link top half into the nozzle.

*Figure 16-8*

3. Torque the Melt Transfer Link COLD to the value specified in the torque chart (see Figure 16-15) or the general assembly diagram.

## Optional Quick Disconnect Terminal Ends

Optional quick disconnect terminal end kits are available on request. The kit consists of:

- QDISC-CRIMP Tool
- TERMCON09 (Power)
- TERMCON10 (Thermocouple)

*Figure 16-9: Power Quick Disconnect Terminal Ends*

*Figure 16-10: Thermocouple Quick Disconnect Terminal Ends*

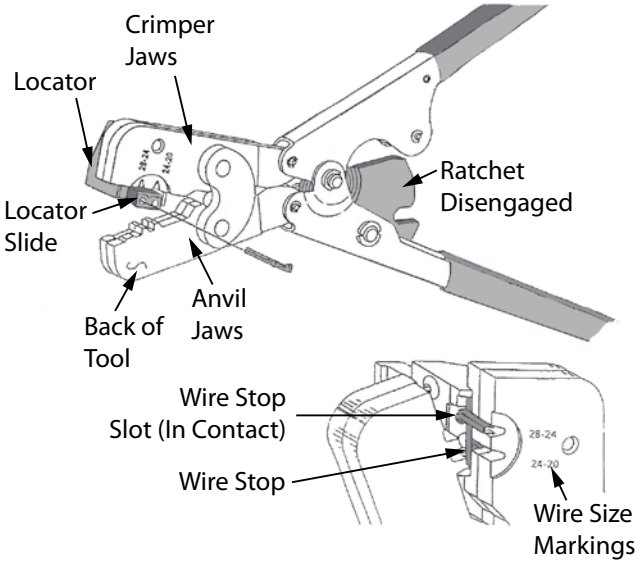


*Figure 16-11: QDISC-CRIMP Tool*

### Crimping the Quick Disconnects

Select the appropriate loose-piece contact and identify the crimp cavity according to the wire size markings on the tool.

1. Hold tool so wire side is facing you. Make sure ratchet is released. Squeeze tool handles together and allow them to open fully.
2. Grasp locator and simultaneously move locator toward anvil jaws and push locator slide into crimper jaws. Spring tension will hold locator position against crimper jaws.
3. Insert contact mating end into appropriate hole in locator slide. Orient contact so wire barrel and insulation barrel are facing crimper jaws (wire size markings).

**CAUTION**
Do not attempt to close tool handles when locator slide is positioned between crimping jaws - damage to the tool jaws and/or locator slide may result.

4. Pull locator slide out of crimping jaws. Spring tension will pull locator down and allow wire stop to enter the slot between barrel and contact shoulder.

**CAUTION**
Make sure both sides of the insulation barrel are started evenly into the crimper jaws - do not attempt to crimp an improperly positioned contact.

5. Squeeze tool handles together until ratchet engages. Do not deform insulation barrel or wire barrel.
6. Insert properly stripped wire contact into the wire barrel until wire butts against the wire stop.
7. Holding wire in place, squeeze tool handles together until ratchet releases. Allow tool handles to open fully. Move locator toward anvil jaws and remove crimped contact.

### Assembling the System with Quick Disconnects

1. When assembling the system, connect female and male connector pins.
2. Then screw male sleeve into female sleeve.

# Assemble Melt-Cube into Cavity Block

If the system has been running:

1. Make sure water to the cover plate is off, then remove the cover plate.
2. Turn on cooling to the rest of plates (especially the cavity plates).

**NOTE**
*Mold-Masters* recommends a separate cooling circuit for the cover plate to be able to assemble and disassemble it without affecting other cooling circuits.

## Melt-Cube Assembly (at cold condition)

Assembly at cold condition, as follows. **Note: For clarity an example 8 cavity demo system is shown.**

1. Install Melt-Cube anti-rotation dowel in each end of the Melt-Cube.

*Figure 16-12*

2. Install Melt-Cube center locator and spacing supports into the back of the cavity block.
3. Insert Melt-Cube into the cavity block. Align the anti-rotation dowels with the slots in the cavity block, while also aligning the Melt-Cube to the Melt-Cube center locator and spacing supports.

*Figure 16-13*

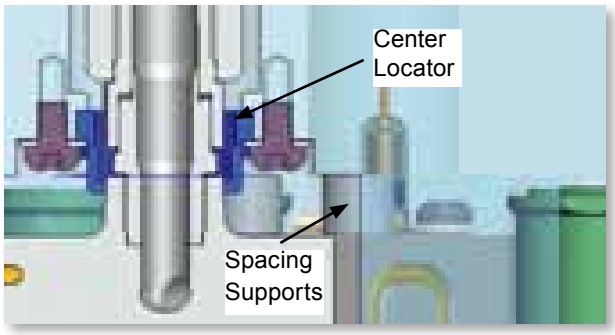


*Figure 16-14*

4. Apply anti-seize to the clamp SHCS's. Install the proper SHCS into each retainer clamp. Install clamps over Melt-Cube at locations shown in GA drawing. Torque as specified in Clamp Screw Torque Chart (see Figure 16-17).

*Figure 16-15*

*Figure 16-16*

| Clamp Screw Torque Chart | | |
|---|---|---|
| SHCS | Component | Torque Value LB-ft (Nm) |
| M6X35 | CLAMP16 | 7.5 (10) |
| M8X35 | CLAMP17 | 12 (16) |
| M8X35 | CLAMP18 | 15 (20) |

*Figure 16-17*

| Melt Transfer Link Torque Chart | | | |
|---|---|---|---|
| Part Number | Description | Torque Value LB-ft (Nm) | Socket Size (mm) |
| MTL015A | Melt Transfer Link Deci Top Half (to nozzle) | 25-28 (34-38) | 19 |
| MTL016A | Melt Transfer Link Centi Top Half (to nozzle) | 20-22 (27-30) | 16 |
| MTL015B | Melt Transfer Link Deci Bottom Half (to Melt-Cube) | 20-22 (27-30) | 17 |
| MTL016B | Melt Transfer Link Centi Bottom Half (to Melt-Cube) | 20-22 (27-30) | 15 |

*Figure 16-18*

5. Install cavity inserts (if applicable), aligning hole with cavity.

*Figure 16-19*

6. Install cavity side retainer / anti-rotation dowel using SHCS. Repeat for all cavities.

*Figure 16-20*

7. Prepare gate seal assembly:

   a. Ensure transfer seal and torpedo are clean.

   b. Install torpedo into transfer seal.

*Figure 16-21*

8. Ensure outside of transfer seal is clean. Slide fit transfer seal into cavity insert hole.

*Figure 16-22*

9. Install wedge dowel pins for locating melt wedges.

*Figure 16-23*

10. Ensure all melt wedge surfaces are clean.

*Figure 16-24*

11. Place melt wedge on pin. Apply anti-seize to two SHCS (M4X20). Insert melt wedge and hand tighten (less than 5 LB-in or 0.56 Nm) until head of screw bottoms. Repeat for opposite cavity melt wedge.

*Figure 16-25*



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12. Install load wedge between melt wedges. Apply anti-seize to SHCS (M5X20) and hand tighten to about 7 LB-in (or 0.79 Nm torque) to make sure all components are in proper contact condition.
13. Then loosen load wedge SHCS one full turn CCW to assure no engagement. Repeat for all load wedges.
14. Once the system is assembled, melt wedge and load wedge screws must be re-tightened at process temperature. See "Retighten Wedge Screws at Hot Condition".

**CAUTION**
Failure to re-tighten wedge screws at process temperature could cause leakage.

*Figure 16-26*

## Retighten Wedge Screws (at Hot Condition)

**CAUTION**
Wedge screws must be tightened once the system is heated to processing temperature. Failure to do so could cause leakage.

**Do not over torque screws.** Use proper torque wrench for LB-in or fraction of Nm scale. Do not use torque wrenches with LB-ft or large scale Nm for tightening the M4 and M5 screws.

1. Set temperature of all hot-runner components to processing temperature according to start up procedure. Make sure all cooling lines other than cover plate are connected properly.
2. After reaching the processing temperature in Melt-Cube let it soak for at least 5 minutes.
3. Tighten the SHCS (M5X20) at the center of load wedge to the proper torque shown in Figure 16-27.

**WARNING**
Potential burn hazard. Use socket extension and heat resistant gloves.

| Load Wedge Screw Torque Chart | | | |
|---|---|---|---|
| **SHCS** | **Tip Angle (°)** | **Temperature** | **Torque Value lb-in (Nm)** |
| M5X20 | 0° | Process Temp | 30 (3.4) |
| M5X20 | 15° | Process Temp | 29 (3.3) |
| M5X20 | 30° | Process Temp | 27 (3.1) |
| M5X20 | 45° | Process Temp | 22 (2.5) |
| M5X20 | 60° | Process Temp | 16 (1.8) |

*Figure 16-27*

| Melt Wedge Screw Torque Chart | | | |
|---|---|---|---|
| **SHCS** | **Tip Angle (°)** | **Temperature** | **Torque Value lb-in (Nm)** |
| M4X20 | All | Process Temp | 30 (3.4) |

*Figure 16-28*

*Figure 16-29*

4. Tighten all melt wedge SHCS (M4x20) in two stages:
   a. First tighten all to 15 LB-in (1.69 Nm) torque
   b. Then tighten all to 30 LB-in (3.38 Nm) torque as shown in Figure 16-28.
5. Assemble cavity block cover plate and connect proper cooling lines.
6. Allow all hot runner components to reach processing temperature.
7. Fill system under low pressure extrude (using screw rotation).
8. Set nozzle temperature 10°F (6°C) lower than melt cube.

**CAUTION**
If the processing temperature is changed by more than 54°F (30°C) then all wedge screws should be loosened at cold condition and the assembly process repeated at cold and process temperature, as explained above.

# Startup and Shutdown

## Startup

1. Heat bridge and inlet to processing temperature.
2. Heat nozzles to processing temperature.
3. Heat Melt-Cube to processing temperature.
4. Allow to heat soak at least 5 minutes.
5. Fill system under low pressure extrude (using screw rotation).
6. Set nozzle temperature 10°F (6°C) lower than Melt -Cube.

## Shutdown

1. Reduce Melt-Cube temperatures to 300°F (150°C).
2. Reduce Nozzle temperatures to 300°F (150°C).
3. Turn off all zones.

# Maintenance - Replacing a Tip

**WARNING**
Potential burn hazard. Use socket extension and heat resistant gloves.

**NOTE**
Before shutting down the molding machine and mold, use maximum screw decompression to remove as much molten plastic from the hot runner system as possible.

1. Make sure the Melt-Cube and related nozzle are at the temperature that the plastic is soft enough to be able to detach runners at gate area.
2. Drain water inside cooling lines of the cover plate of the cavities and then remove the cover plate.
3. Loosen and take out the SCHC M5X20 at the center of the load wedge of tip to be replaced.
4. Use SHCS M6X100 in the tool kit to extract required load wedge.

*Figure 16-30*

5. Loosen and take out the two SCHC M4X20 on the melt wedge.
6. Use the two SHCS M5X100 in the tool kit to extract related melt wedge.

*Figure 16-31*

7. Let the system cool down to almost room temperature.
8. Take out the transfer seal and related torpedo assembly from the cavity plate. You may use proper pliers with soft tips (brass) and suitable hole or may use screw-drivers with soft tip (brass) to pry transfer seal at the groove close to its wider diameter.

*Figure 16-32*

9. Clean the parts and interfaces gently and replace needed parts (usually the torpedo).

**CAUTION**
The flat sealing interfaces of the removed melt wedges should be treated very gently. Any rough scratch may become a source of leakage.

10. To clean the sealing surfaces of the removed melt wedges, it is recommended to use soft sandpaper (500 grit) placed on a completely flat surface (ground flat surface or proper granite measurement base). Rub the surfaces gently with a few strokes on the sand paper.

*Figure 16-33*

11. Loosen SHCS on opposite side of the melt wedge to have only 5 lb-in torque, as well.
12. Reassemble following steps in section titled *Melt-Cube Assembly (at cold condition).* Complete these steps for any two sets of seals that are a mirror of one another and have been loosened (to have balanced forces on interfaces of both sides during reassembly).

# Section 17 - Troubleshooting

## Introduction

This troubleshooting information assumes that the hot runner has been operational.

Basic rules for troubleshooting are:

- Define the problem; what is seen is only a symptom of the underlying problem.
- Develop a method to isolate the problem.
- Test one item at a time to verify results.
- Monitor the final solution to verify that the problem has been solved. Repeat occurrences of the same symptom may indicate other problems.
- Document the solution so that a repeat occurrence can be solved quickly.
- Consult other resources to augment the troubleshooting information in this manual. One of the best resources may be your resin supplier.

**NOTE**
Refer back to **Section 3: Safety** for proper procedures to be followed.

**WARNING**
Extreme heat. Avoid contact with heated surfaces. To avoid serious burns wear safety clothing consisting of a protective heat resistant coat and heat-resistant gloves. Use adequate ventilation for fumes. Failure to do so can result in a serious injury.
Make sure the machine has been locked out and tagged out in accordance to the machines documented procedures. Failure to do so may lead to serious injury or death.

## Moisture Related Issues

Many common molding issues can be directly attributed to moisture contamination of the production resin. Generally, manufacturing resin is supplied from the manufacturer in ready to process pellets that are in sealed, airtight containers. Follow manufacturers storage instructions, keeping containers sealed until ready to use. Prior to using pellets, follow the drying instructions, as provided by the resin supplier and molding machine manufacturer (if applicable).

### Resin Moisture Contamination

Moisture can be introduced into the resin in many ways:

- During transportation
- Environmental exposure (aging)
- Malfunctioning heater/dryer
- Extreme humidity in atmosphere
- Inadequate or malfunctioning facility HVAC

### Resin Drying Issues

During the drying stage of the resin (if applicable), ensure that:

- The resin pellets are not overpacked
- Adequate air circulation is present
- The drying system is properly sealed, according to manufacturers instructions

### Importance of Pre-Drying Resin

Thermoplastic resins can be hygroscopic, able to absorb moisture from the air. Under normal processing conditions, this can lead to degradation of the polymer during molding. Breakage of polymer chains changes the properties, resulting in possible blisters, streaks, splay or other defects described in this section.

Recycled resins can have higher hygroscopic properties due to greater surface area and should be dried separately from fresh resins.

If moisture issues are ruled out, continue with the troubleshooting tables in the following pages.


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## Pre-Molding Precautions

Prior to commencing production, ensure that the following conditions have been met. This will greatly reduce any future need to troubleshoot defective production.

### History

- Review any documentation associated with your batch job regarding the recipe using the mold, molding machine, thermoplastic resin, environmental setting, etc.
- Review comments, notes, logbooks, blogs, and anything other resource material that pertains to the batch job.
- Verify that all settings such as all time, temperature, pressure, material, etc. are correct.

### Material

- Ensure that the thermoplastic resin to be used is the right grade, and has been stored and/or prepared/dried, etc, according to manufacturers specs.
- Verify that the pigment/dye to be used meets manufacturers specifications, and is compatible with the resin/molding machine/mold.
- Verify the correct recycle ratio and adjust settings accordingly.

### Hardware

- Make sure the mold has been properly stored, and is dry, clean, free of rust, dirt, moisture, residual resin, pigment and any protective coating.
- Check that the temperature controller meets requirements, and is fully tested and operational.
- The injection molding machine has been properly maintained, cleaned, lubricated; tolerances and dimensions verified.
- Make sure that the nozzles, cylinders, valves, gates, and any other variable that is appropriate for the batch job has been chosen.

### Settings

Ensure that all batch job parameters are correct:

- Temperatures
- Pressures
- Injection Speed
- Back Pressure

## Establishing Root Cause

This section is to be used as a reference tool only.

When a system that has been set up according to specification and was functioning normally suddenly produces sub-standard parts, the data in the following pages may be used to determine the possible cause, but only should be used as a guide.

A correct set up procedure that has been proven in will produce parts that meet design tolerances and specifications. A sudden change in any parameter indicates a possible fault. Rather than modify other settings to compensate for this variation, it is advisable to determine which of the original settings has changed.

## Fault Identification

The operator will need to evaluate all the possible conditions which may have caused the defect.

- Identify the problem
- Determine the frequency
- Is the problem random or in the same location
- Review past history logs for similar occurrences and resolutions.

Review the machine settings to ensure that there is no variation from the original set-up which was producing standard parts.

| | |
|---|---|
| injection speed | melt heating |
| screw speed | locking |
| melt temperature | cushion |
| back pressure | mold heating |

For a more thorough analysis of the defect, refer to the **Troubleshooting Section** in the following pages.


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# Defect Types, Causes and Remedies Index

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# Parts have Dark Specks

The finished product contains dark particles.
(When transparent resins are usually used.)

## Probable Cause:

### Molding Machine

- Offline for extended period
- Barrel offline for extended period
- Barrel improperly purged
- Contamination in plasticizer
- Wrong nozzle
- Use of wrong screw

### Mold

- Gate and/or runner has dead spots

### Material

- Physical contamination of raw material
- Chemical contamination of raw material
- Particulate contamination from machine barrel

### Solution

- Purge system with appropriate material
- Trace source of contamination and repair, remove or discard
- Adjust melt temperature if necessary
- Inspect for dead spots: gates; runners; nozzle; back flow valve
- Inspect feed screw for degradation

# Parts have Blisters and/or Bubbles

The finished product contains small gas or air filled pockets or cooling voids.

## Probable Cause:

### Molding Machine

- Low Injection Pressure
- Back flow valve malfunctioning
- Suck-back cycle too long
- Rapid plasticizing
- Trapped air in feed
- Feed error

### Mold

- Trapped or volatile gas
- Low mold temperature
- Poor thin/thick transition phase
- Inadequate venting

### Material

- Overheating of resin

### Solution

- Verify control and/or holding pressure
- Increase back pressure
- Increase mold temperature
- Inspect back flow valve
- Ensure proper venting
- Increase gate size
- Decrease vent land length

# Parts have Flow Marks

The finished product exhibits blush and flow marks, due to variations in material temperature from gradients between the machine nozzle and mold sprue bushing. Cold material in the nozzle tip section results in a halo around the direct sprue.

## Probable Cause:

### Molding Machine

- Wrong injection speed
- Wrong injection pressure
- Hold pressure too long

### Mold

- Insufficient mold cooling
- Temperature of mold too high around the gate
- Temperature of mold too cool
- Gate size is too small
- Gate is in wrong location
- Land length of gate is too long

### Material

- Melt temperature is too low

## Solution

- Adjust injection speed
- Add a large cold slug area
- Add cold wells at the end of the runner system
- Use hot sprue bushing
- Identify and eliminate dead pockets or sections

# Parts have Burn Marks

The finished product display brown streaks. This is from the material being overheated due to trapped air (diesel effect), which can lighten or darken the color.

### Probable Cause:

#### Molding Machine

- High injection speed
- Backflow/check ring valve malfunctioning
- High back pressure

#### Mold

- Trapped or volatile gas
- Burning due to friction
- Incorrect sprue diameter

#### Material

- Overheated/underheated melt, possible shear

#### Solution

- Clear blocked vent channels
- Lower injection speed
- Lower injection pressure
- Check heater functionality
- Check thermocouple functionality
- Reduce feed screw rotation
- Reduce melt temperature
- Increase mold cavity venting
- Enlarge gate
- Change gate position and/or size

# Parts are Delaminating

The finished product is separating into layers that can be peeled off; surface layers are flaking off.
Insufficient layer bonding as a result of high shear stresses; non-homogenious material.

## Probable Cause:

### Molding Machine

- High injection speed

### Mold

- Cold mold
- Gate has sharp corners
- Sharp corners causing shear heat

### Material

- Physical contamination of raw material
- Chemical contamination of raw material
- Melt too hot; poor melt
- Incompatible color dye
- High percentage of recycled material

### Solution

- Melt temperature increased
- Mold temperature increased
- Injection speed decreased
- Contamination eliminated
- Regrind ratio adjusted
- Resin moisture content adjusted/changed
- System purged
- Sharp corners at gate reduced


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# Parts have Dimensional Irregularities

The finished product is of a different dimensional value than originally designed, or previous production.

## Probable Cause:

### Molding Machine

- Low injection pressure
- Short hold pressure time
- Damaged back-flow/check ring valve
- Short cycle time
- Cylinder clearance too big
- Nozzle heaters malfunctioning

### Mold

- Temperature setting is too high
- Small gate size resulting in wrong pressure
- Incorrect gate location
- Incorrect mold configuration/size

### Material

- Generally not a material related issue unless excessive regrind is used

### Solution

- Increase the injection pressure
- Increase the cooling time
- Increase the mold temperature
- Ensure cycle time is consistent
- Monitor molding machine for irregularities
- Balance regrind ratio
- Increase gate size
- Decrease gate land length
- Balance the runner and/or gate system
- Decrease cavity quantity

# Parts are Discolored

The finished product varies in color on different surfaces.

## Probable Cause:

### Molding Machine

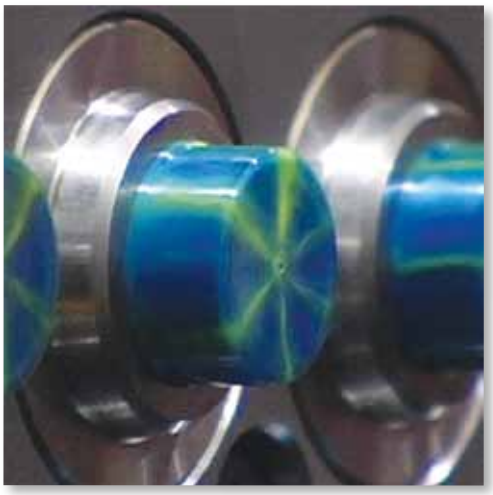
- Contamination

### Mold

- Incorrect sprue diameter
- Inadequate venting

### Material

- Physical contamination of raw material
- Chemical contamination of raw material
- Melt too hot; poor melt
- Incompatible color dye
- Residence time too high

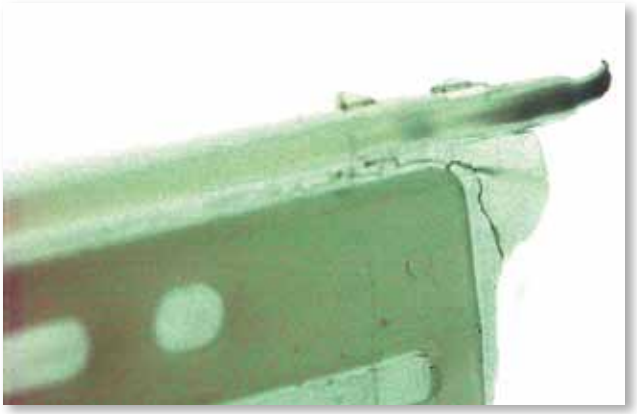


### Solution

- Heating cylinder purged
- Resin temperature lowered by:
  a. reducing cylinder temperature
  b. reducing screw speed
  c. reducing back pressure
- Nozzle temperature decreased
- Residence time adjusted
- Regrind ratio adjusted
- Cycle time adjusted
- Check for external contamination sources
- Ensure proper cooling in all areas.
- Increase mold venting

# Parts Contain Flash

Also known as "Fins" or "Spew".
The finished product contains a thin film of material attached at the mold parting line.



## Probable Cause:

### Molding Machine

- Low clamping pressure
- High injection pressure
- High injection speed

### Mold

- Inadequate mold supports
- Low clamping force
- Damaged mold
- Projected area too large for machine capacity

### Material

- Low melt viscosity
- High melt temperature

### Solution

- Reduce the injection speed
- Reduce the injection pressure
- Reduce the injection time
- Increase clamping force
- Inspect the mold for irregularities
- Reduce the melt temperature
- Inspect vent depth
- Switch to higher tonnage clamping machine
- Establish correct transfer position
- Reduce hold pressure

# Parts Surface has Jetting

The finished product exhibits serpentine flow patterns on the surface as a result of the melt cooling prior to complete filling of the mold.

## Probable Cause:

### Molding Machine

- High injection speed

### Mold

- Cold mold
- Small gate
- Wrong gate land length
- Wrong gate location

### Material

- Cold melt

### Solution

- Decrease injection speed
- Verify nozzle temperature
- Increase mold temperature
- Increase melt temperature
- Increase gate size
- Modify gate location

## Parts are Pitted

The finished product contains unmelted particles or small holes on the surface.

### Probable Cause:

#### Molding Machine

- Improper or worn out feed screw
- Low melt temperature
- Low injection speed

#### Mold

- Gating shear
- Sharp corners

#### Material

- Resin used is not homogeneous
- External contamination

#### Solution

- Reduce shear
- Reduce back pressure
- Reduce injection speed
- Modify temperature
- Modify regrind ratio
- Modify shot size
- Inspect hot runner and nozzles

# Parts Surface is Rough

The finished product exhibits patterns on the surface similar to grooves on a record, due to rapid cooling of the melt as it nears mold surface, followed over and over again by fresh melt.

## Probable Cause:

### Molding Machine

- Low injection speed
- Low injection pressure

### Mold

- Cold mold
- Irregularities in mold surface; defective polishing

### Material

- Cold melt

## Solution

- Increase injection speed
- Increase injection pressure
- Increase melt temperature
- Increase mold temperature
- Inspect mold surface

# Parts are Sticking to Cavity

The finished product does not properly release from the mold (female side).

## Probable Cause:

### Molding Machine

- High injection pressure
- High injection speed
- Long holding time
- High material feed

### Mold

- Hot cavity
- Cold mold
- Defective mold surface

### Material

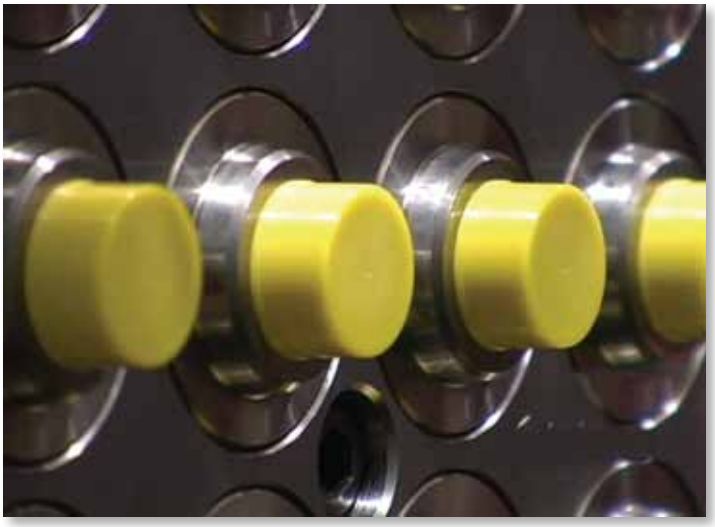
- Melt too hot

### Solution

- Confirm cycle time for cooling
- Reduce injection pressure
- Reduce injection hold time
- Reduce injection speed
- Reduce injection time
- Adjust feed
- Inspect mold finish
- Increase mold opening cycle
- Lower mold temperature
- Adjust differential temperatures
- Inspect for appropriate mold release

# Parts are Sticking to Core

The finished product does not properly release from the mold (male side).



## Probable Cause:

### Molding Machine

- High injection pressure

### Mold

- Improper mold temperature
- Bending of core
- Presence of vacuum

### Material

- Wrong resin selection

## Solution

- Confirm cycle time for cooling
- Reduce injection pressure
- Reduce injection hold time
- Reduce injection time
- Adjust feed
- Reduce mold closed time
- Increase core temperature
- Decrease nozzle temperature
- Inspect mold for undercuts and/or improper draft
- Verify mold bending ratio

# Parts are Short

The finished product is not completely formed.

### Probable Cause:

#### Molding Machine

- Feed system issue
- Low injection pressure
- Low injection speed
- Short injection time
- Back flow valve or check ring faulty
- Improper venting

#### Mold

- Insufficient venting
- Cold mold

#### Material

- Low melt temperature
- Viscous material

#### Solution

- Check venting
- Increase feed
- Increase injection pressure
- Increase feed temperature by increasing cylinder temperature
- Increase injection time
- Increase mold temperature
- Increase nozzle diameter
- Inspect for restrictions
- Increase gate size of sprue and runner system

# Parts have Sinks or Voids

The finished product has hollows and pockets in areas that do not cool sufficiently, causing contraction.

## Probable Cause:

### Molding Machine

- Low injection pressure
- Short injection time
- Insufficient material in cavity
- High injection speed
- Low back pressure
- Damaged backflow valve / check ring

### Mold

- Mold not at required temperature
- Small gate leading to early freezing
- Gate land length too long
- Incorrect rib/wall dimensions
- Material flow incorrect
- Thick wall part

### Material

- Hot material
- Material wrong grade for application

## Solution

- Adjust injection speed
- Increase injection hold time
- Increase injection pressure
- Adjust melt temperature
- Adjust mold temperature
- Inspect for hot spots
- Enlarge and/or add vents to mold parting line
- Increase sprue or runner size
- Increase gate size/reduce gate land length
- Relocate gate closer to heavy/thicker areas
- If possible, core out heavy wall sections

# Parts Display Splay

The finished product display splay/splash marks and/or silver streaks.

### Probable Cause:

#### Molding Machine

- Resin degraded from overheating
- Cylinder contains hot spots
- Material trapped at nozzle tip
- Wrong injection pressure
- Wrong injection speed
- Low back pressure

#### Mold

- Friction related burning in gate, nozzle or hot runner
- Trapped volatile compounds

#### Material

- Hot melt
- Contaminated resin (moisture, dirt, organics)
- Degraded resin

#### Solution

- Dry resin according to procedure; check drying equipment for functionality
- Reduce nozzle temperature
- Reduce material temperature:
  1. lower cylinder temperature; 2. reduce screw speed; 3. reduce back pressure
- Decrease injection speed
- Increase mold temperature
- Decrease or eliminate screw decompression
- Reduce cycle time
- Check for drooling
- Check for contamination in mold cavity
- Open gates
- Try mold in smaller shot-size press

# Parts are Streaked

The finished product has large, dull and laminate appearance areas on the surface.

## Probable Cause:

### Molding Machine

- Back flow valve ring damaged

### Mold

- Hot spots
- Material trapped in certain areas

### Material

- Contamination of resin or machine
- If pattern is identical, cause may be the machine
- If pattern is erratic, cause may be the material or coloring
- Degraded or unstable material

### Solution

- Check for contamination
- Check barrel purging
- Inspect back flow ring for wear or cracks
- Inspect feed screw for wear and tear
- Inspect screw/barrel for tolerances
- Verify heater operation
- Verify thermocouple operation

# Parts are Stringing

The finished product has thin plastic strings attached to the sprue.

## Probable Cause:

### Molding Machine

- High back pressure
- High nozzle temperature

### Mold

- Incorrect sprue

### Material

- Melt strength inadequate

### Solution

- Reduce back pressure
- Modify nozzle temperature
- Modify temperature profile
- Eliminate sprue breaks
- Increase cooling time
- Decrease mold temperature at the gate

# Parts are Warped

The finished product has pressure differences/stress on its surface, causing the part to be disfigured.

## Probable Cause:

### Molding Machine

- Wrong cooling time
- High injection pressure

### Mold

- Gate located in wrong area
- Undercuts too big
- Cavity too hot
- Part is wrong design or too heavy

### Material

- Fillers have wrong orientation
- Incorrect material

## Solution

- Ensure temperature in both mold halves is equal
- Monitor part ejection from mold for uniformity
- Monitor part handling following ejection
- Verify part weight following ejection
- Increase injection hold time
- Increase cooling time
- Adjust injection pressure
- Adjust mold temperature; set sequential temperatures based on part geometry
- Check gate dimensions, quantities and locations
- Re-design part if necessary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# Parts have Weld Lines

The finished product has lines where two flow fronts meet and have not fused, creating the possibility of weak areas and stress fractures.

## Probable Cause:

### Molding Machine

- Low injection speed
- Low injection pressure
- Short injection time forward

### Mold

- Low mold temperature
- Poor venting
- Back flow valve / check ring malfunctioning
- Gates too far apart
- Redesign part

### Material

- Cold melt
- Material wrong grade for application

### Solution

- Increase injection pressure
- Increase injection holding time
- Increase injection speed
- Increase cylinder temperature
- Increase mold temperature
- Check for venting
- Provide an overflow well adjacent to the weld area
- Modify the gate location
- Decrease gate land length

# Section 18 - Glossary of Terms

**Aspect Ratio:** Ratio of total flow length to average wall thickness.

**Back Pressure:** The pressure applied to the plastic during screw recovery. By increasing back pressure, mixing and plasticating are improved; however, screw recovery rates are reduced.

**Backplate:** Inlet component to the hot runner manifold.

**Barrel**: The part of the molding press where resin is melted.

**B-Side:** The mold half that mounts to the moving side of the injection molding press. Sometimes referred to as the core side of the mold or the cold half, the B-Side has ejector pins to push the part out of the open mold. An analysis of the part geometry determines the optimal part orientation to ensure that it will remain on the B-Side when the mold is opened

**Clamp Force:** The force required to hold the mold shut so resin cannot escape during injection.

**Contoured Pins:** Ejector pins with the ends shaped to match a sloping surface on the part.

**Core:** A convex feature on either side of the mold that will enter an opposing cavity when the mold is closed. The void between the cavity and core is where the resin solidifies and forms the part. Often the B-side of a mold is referred to as the core side.

**Core-cavity:** The design of a mold where the A-side forms the outside of the part and the B-side forms the inside. The advantage to this approach is that the part will shrink onto the B-side so it can be ejected, and if the inside and outside are drafted with equal and opposite draft the wall thickness will be constant.

**Cycle Time:** The time it takes to make one part including the closing of the mold, the injection of the resin, the solidification of the part, the opening of the mold and the ejection of the part.

**Cavity:** The space inside a mold into which material is injected.

**Clamp:** The part of an injection molding machine incorporating the platens that provides the force necessary to hold the mold closed during injection of the molten resin and open the mold to eject the molded part.

**Clamping Plate:** A plate fitted to a mold and used to fasten the mold to a platen.

**Clamping Pressure**: The pressure applied to the mold to keep it closed during a cycle, usually expressed in tons.

**Closed-loop Control:** System for monitoring complete, injection molding- process conditions of temperature, pressure and time, and automatically making any changes required to keep part production within preset tolerances.

**Cooling Channels:** Channels located within the body of a mold through which a cooling medium is circulated to control the mold surface temperature.

**Cushion:** Extra material left in barrel during cycle to try and ensure that the part is packed out during the hold time.

**Cycle:** The complete sequence of operations in a process to complete one set of moldings. The cycle is taken at a point in the operation and ends when this point is again reached and moving platens of the clamp unit in the fully open position.

**Cycle Time:** The time required by an injection molding system to mold a part.

**Dwell:** A pause in the applied pressure to a mold during the injection cycle just before the mold is completely closed. This dwell allows any gases formed or present to escape from the molding material.

**Ejector Pins:** Pins that are pushed into a mold cavity from the rear as the mold opens to force the finished part out of the mold. Also called knockout pins.

**Ejector Return Pins:** Projections that push the ejector assembly back as the mold closes. Also called surface pins or return pins.

**Ejector Rod:** A bar that actuates the ejector assembly when the mold opens.

**Family Mold:** A multi-cavity mold where each of the cavities forms one of the component parts of an assembled finished part.

**Fill:** The packing of the cavity or cavities of the mold as required to give a complete part or parts that are free of flash.

**Flow:** A qualitative description of the fluidity of a plastic material during the process of molding. A measure of its moldability generally expressed as melt flow rate or melt index.

**Gate:** An orifice through which the melt enters the mold cavity.

**Hot Tip Gate:** An injection molding method that uses a heated gate on the A-side of the part to eliminate the creation of any runner or sprue. The gate vestige will be a small sharp bump that can be trimmed if necessary.

**Hot Runner Mold:** A mold in which the runners are insulated from the chilled cavities and are kept hot. Hot runner molds make parts that have no scrap.

**Injection:** The process of forcing melted resin into a mold.

**Injection Pressure:** The pressure on the face of the injection screw or ram when injecting material into the mold, usually expressed in PSI OR BAR.

**Knockout Pins:** A rod or device for knocking a finished part out of a mold.

**L/D Ratio:** A term used to help define an injection screw. This is the screw length-to-diameter ratio.

**Manifolds:** distribute melt from the inlet component to one or more sub-manifolds WITHIN A HOT RUNNER.

**Melt Flow Rate:** A measure of the molten viscosity of a polymer determined by the weight of polymer extruded through an orifice under specified conditions of pressure and temperature. Particular conditions are dependent upon the type of polymer being tested. MFR usually is reported in grams per 10 minutes. Melt flow rate defines the flow of a polypropylene resin. An extrusion weight of 2160 grams at 446°F (230°C) is used.

**Melt Flow Index:** Term that defines the melt flow rate of a polyethylene resin. An extrusion weight of 2160 grams at 310°F (190°C) is used.

**Mold:** A series of machined steel plates containing cavities into which plastic resin is injected to form a part.

**Mold Frame:** A series of steel plates which contain mold components, including cavities, cores, runner system, cooling system, ejection system, etc.

**Mold-Temperature-Control Unit:** Auxiliary equipment used to control Hot Runner temperature. Some units can both heat and cool the mold. Others, called chillers, only cool the mold.

**Moving Platen:** The platen of an injection molding machine that is moved by a hydraulic ram or mechanical toggle.

**Multi-Cavity Mold:** A mold having two or more impressions for forming finished items in one machine cycle.

**Multi-Material Molding:** The injection of two-or-more materials, in sequence, into a single mold during a single molding cycle. The injection molding machine is equipped with two-or-more plasticators. (See also co-injection)

**Nest Plate:** A retainer plate in the mold with a depressed area for cavity blocks.

**Non-Fill:** See short shot.

**Non-Return Valve:** Screw tip that allows for material to flow in one direction and closes to prevent back flow and inject material into the mold.

**Machine Nozzle:** The hollow-cored, metal nose screwed into the injection end of a plasticator. The nozzle matches the depression in the mold. This nozzle allows transfer of the melt from the plasticator to the runner system and cavities.

**Packing:** The filling of the mold cavity or cavities as full as possible without causing undue stress on the molds or causing flash to appear on the finished parts. Over- or under-packing results in less than optimum fill.

**PET:** Polyethylene Terephthalate, a type of polyester and a leading recyclable plastic material.

**Pinpoint Gate:** A restricted gate of 0.030 in or less in diameter, this gate is common on hot runner molds.

**Platens:** The mounting plates of a press on which the mold halves are attached.

**Preform:** A plastic test tube shaped part produced by injection molding systems in the first step of a two-stage injection molding and blow molding process used to produce PET bottles or containers. The perform is subsequently re-heated and stretch blown through a blow molding process into the final container shape.

**Pressure Disk:** Manifold component designed to be compressed by thermal expansive forces to form part of the plastic sealing mechanism. Also helps to reduce thermal transfer to a minimum.

**Process:** The injection molding environment consisting of input variables such as temperature, pressure, injection rates and time that are controlled to fill the mold while optimizing the trade-offs between cosmetics and dimensional accuracy.

**Ram:** The forward motion of the screw in the barrel that forces the melt into the mold cavity.

**Recovery Time:** The length of time for the screw to rotate and create a shot.

**Restricted Gate:** A very small orifice between runner and cavity in an injection mold. When the part is ejected, this gate readily breaks free of the runner system. Generally, the part drops through one chute and the runner system through another leading to a granulator and scrap reclaim system.

**Retainer Plate:** The plate on which demountable pieces, such as mold cavities, ejector pins, guide pins and bushings are mounted during molding.

**Ring Gate:** Used on some cylindrical shapes. This gate encircles the core to permit the melt to first move around the core before filling the cavity.

**Runner:** The channel that connects the sprue with the gate for transferring the melt to the cavities.

**Runnerless Molding:** See hot runner mold.

**Screw Travel:** The distance the screw travels forward when filling the mold cavity.

**Shear:** The force between layers of resin as they slide against each other or the surface of the mold. The resulting friction causes some heating of the resin.

**Short Shot:** Failure to completely fill the part or cavities of the mold. Edges may appear melted.

**Shot:** The complete amount of melt injected during a molding cycle, including that which fills the runner system.

**Shot Capacity:** Generally based on polystyrene, this is the maximum weight of plastic that can be displaced or injected by a single injection stroke. Generally expressed as ounces of polystyrene.

**Single-Cavity Mold:** A mold having only one cavity and producing only one finished part per cycle.

**Sprue Bushing:** A hardened-steel insert in the mold that accepts the Screw nozzle and provides an opening for transferring the melt.

**Sprue Gate:** A passageway through which melt flows from the nozzle to the mold cavity.

**Sprue:** The feed opening provided in injection molding between the nozzle and cavity or runner system.

**Stationary Platen:** The large front plate of an injection molding press to which the front plate of the mold is secured. This platen does not move during normal operation.

**Thermoplastic:** A polymer which melts or flows when heated. Thermoplastic polymers are usually not highly cross-linked, and act much like molecular solids: low melting and boiling points, high ductile strength.

**Thermoset:** A polymer that doesn't melt when heated. Thermoset polymers "set" into a given shape when first made and afterwards do not flow or melt, but rather decompose upon heating. They are often highly cross-linked polymers, with properties similar to those of network covalent solids, i.e., hard and strong.

**Valve Disk:** Manifold component designed to be compressed by thermal expansive forces to form part of the plastic sealing mechanism. It's high tolerance bore allows the valve pin to shift through it without plastic leakage and part of it enters the melt stream and helps guide the plastic flow without stagnation.

**Valve Gating:** An injection molding method that uses a mechanical shut off to open and close the gate orifice.

**Vent:** A shallow channel or opening cut in the cavity to allow air or gases to escape as the melt fills the cavity.

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NOTE TO MOLD MAKER:

This detailed user manual has been prepared to assist in the integration, processing and troubleshooting of your Mold-Masters® System.

When this hot runner system has been integrated into the mold, please ensure that this user manual is forwarded to the molder / end user together with the mold.



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